SCIENTIFIC AMERICAN

LELAND·STANFORD·JVNIOR·VNIVERSITY


Scientific American
AN ILLUSTRATED JOURNAL of ART, SCIENCE & MECHANICS
VOL. XLII.
NEW-YORK
PUBLISHED BY MUNN & CO.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 1. [NEW SERIES.]

NEW YORK, JANUARY 3, 1880.

[$3.20 per Annum. [POSTAGE PREPAID.]

A FEW NOVELTIES.

The device represented in Fig. 1 in the engraving is an improved automatic liquid weigher, invented by Mr. Lewis N. Watts, of Indianapolis, Ind. The scales in connection with the weighted elbow lever, A, are placed in the proper relative position to the faucet of the barrel, so that the receptacle into which the liquid is to be drawn may set on the platform of the scales. The receptacle is counterbalanced with weights, and enough more weight is added so that the scale will tip when the desired quantity of liquid has been drawn. The weighted end, B, of the lever, A, is raised to a vertical position, and the faucet opened. When enough of the liquid has run into the receptacle to tip the scale, the scale pan touches the horizontal arm of the lever, A, when the weighted end, B, falls on the handle of the faucet and stops the flow of the liquid.

An improved steam fog alarm, recently patented by Mr. William Leighton, of West Pembroke, Me., is shown partly in section in Fig. 2. It is intended to re-enforce and strengthen the sound of a steam whistle and to project the sound in one direction. It consists of a fog horn containing a steam whistle, behind which there is an adjustable resonance chamber.

The whistle is of peculiar construction, having straight parallel sides and straight orifices to give great volume of sound in a particular direction, instead of expending the force in all directions, as in the case with a whistle having an annular orifice.

Fig. 3 shows two forms of seed package, invented by Mr. Carl O. Wolferts, of Hicksville, N. Y. The novelty of this invention consists in placing the seed in a wrapping of paper at suitable distances apart for planting. For seeds that are to be planted in rows, the packages are made in continuous narrow strips, with the seed fixed between the folds, so that they may be rolled up in compact form for keeping. Such seeds as are usually planted in hills are fixed between disks of paper in the proper number and distance for forming a hill, and the separate packages are connected by a band or ribbon to secure uniformity in the spacing of the hills. By these means the seeds can be planted uniformly as to depth and distance apart.

The magnets, A, in the electro-magnetic motor shown in Fig. 4 are elongated and notched at B, to increase their attractive surface, and the armature, C, is provided with projecting teeth corresponding with the notches in the magnets. The motor is provided with a resistance coil which assists in demagnetizing the last acting magnet and prevents sparks at the commutator. A device is provided by which the motor may at any time be reversed. This motor is the invention of Mr. John C. Ludwig, of San Francisco, California.

Fig. 5 represents an adjustable wash bowl patented by Messrs. J. L. Knight and S. Smith, of Topeka, Kan. The bowl is provided with hot and cold water supply pipes and with a waste pipe hinged together and provided with the necessary stop cocks.

An improved tap for tin cans, patented by Messrs. John T. Cooper and Julius Wagner, of Silver Reef, Utah Ter., is shown in Figs. 6 and 7. The invention consists of a bell-shaped body, A, provided with a stopcock and having a central spindle extending through it, carrying at one end an arrow-shaped head, B, for puncturing the can and holding the tap, and at the other end a wing-nut for drawing the bell-shaped body against the head of the can. The head, B, is projected some distance beyond the body, A, and forced through the top of the can; it is then turned through a quarter of a revolution and drawn up against the can top by the wing-nut.

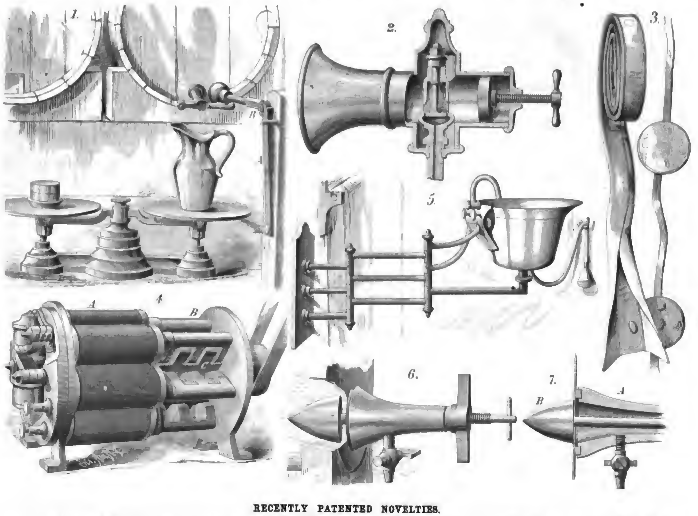
The body, A, is provided with a packing at each end to prevent the escape of the liquid. When the device is once in place the contents of the can may at any time be drawn out through the stopcock.

Still Another Letter Copying Process.

Herr Adler has communicated to the Vienna Photographic Society a multiplying process based upon the use of the *glue plate*, consisting of gelatine, glycerine, and water (though the last-mentioned ingredient is present in a smaller quantity than usual), used in the hektograph and other similar processes. For writing or drawing Herr Adler uses a concentrated solution of alum, to which, in order to render the writing or drawing visible upon the paper, a few drops of some aniline color is added. Before laying the writing or drawing upon the gelatine surface pass a damp sponge over the latter, and allow the moisture to sink in for a few minutes so as to have a greater effect upon the alum. Then lay the written side downward upon the gelatine, and, after the lapse of a few minutes, on removing it the writing will be found reversed and eaten into the gelatine film as if it were engraved. By means of an India-rubber roller a little common printing ink is spread over the plate and absorbed by the lines sunk by the alum, and again rejected on the application of moisture upon the paper laid down upon it, and smoothed over it by the flat hand. When removed this paper will have upon it the first impression of the writing or drawing. For each succeeding impression the plate must be inked, as in lithography, by the India-rubber roller. A considerable number of impressions can be taken.

Fusibility of Metals.

By means of extremely delicate processes, M. Violle has lately determined the fusing points of the more refractory metals. The following are given as the exact temperatures for five of these metals in the order of their fusibility: Silver, 1,749° Fah.; gold, 1,863°; copper, 1,890°; platinum, 3,195°; iridium, 3,510°. It will be seen that pure copper requires a higher temperature to fuse it than gold; ordinary commercial copper, however, melts below 1,085°. Iridium is the most difficult of all metals.



RECENTLY PATENTED NOVELTIES.

FIG. 1.—Automatic Liquid Weigher. FIG. 2.—Steam Fog Alarm. FIG. 3.—Improved Seed Package. FIG. 4.—Electro-Magnetic Motor. FIG. 5.—Adjustable Wash Bowl. FIGS. 6 and 7.—Tap for Tin Cans.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information. (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, JANUARY 3, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 209.

For the Week ending January 3, 1880.

Price 10 cents. For sale by all newsdealers.

A NEW POLICY IN LAW.

The impolicy of buying any species of property, without first making sure that the would-be seller has a legal right to sell, has been pretty thoroughly learned by most men. There are swindlers in every business, who are never better pleased than when they can "sell" an over-confiding buyer by persuading him to pay for property to which they can give no title. And when the dishonest seller has taken himself out of the way, and the honest but incautious buyer finds that he has paid for something he cannot hold, the real title being vested in another, the case seems very hard. But the fact that the buyer purchased in good faith is not accepted in any court as a valid reason for his holding the property against the actual owner. To overturn this just rule of the law would open the way to no end of injustice. It would make it impossible for the owner of any piece of property to retain possession of it, unless he were endowed with practical omniscience and omnipresence, that he might always know when and where he was likely to be defrauded by a false sale in which the purchaser should act in good faith, and at the same time be able to appear on the spot at the critical moment to disprove the fraudulent seller's claim to proprietorship. On such terms no property would be worth the trouble and cost of maintaining possession of it.

For instance, what would any man's farm be worth if any swindler could sell it from under him; or, what amounts to the same thing, if any buyer, purchasing in good faith, could hold the property on that plea alone and in spite of the seller's lack of ownership? Or what would any horse or wagon, plow or thrashing machine be worth, if any thief could sell it and the purchaser's title be good simply because he bought in good faith and for his own use?

It is sheer absurdity to ask such questions; and no one would be quicker than farmers to denounce such a reversal of the rules of law, were such a thing proposed, however much the innocent purchaser might suffer from his investments in stolen goods. The courts very properly hold that it is the buyer's business to find out whether the man he buys of has a right to sell; and if he neglects so to do, he, and not the true owner, must suffer the consequences. The law will punish the fraudulent seller if he can be caught and convicted; but it is no part of its business to make good the buyer's loss—certainly not at the cost of the real owner of the property.

The nature of the property sold does not alter in any way the moral or legal principles involved. The buyer can gain no title beyond that which the seller is able to convey. This is common sense, as it is common law. Yet a body of people styling themselves the National Grange Patrons of Husbandry have had the assurance to petition Congress to reverse this rule in all questions pertaining to patent rights. And the farmers of Northern Indiana have induced their representative, Mr. Baker, to introduce into the House a bill designed to make good faith on the part of the purchaser of a patent right a legal title to ownership, though the seller has no title to convey.

That a great many farmers have been swindled by fraudulent patent sellers is only too true. So other men have bought stolen horses in good faith, and town lots to which the seller had no legal title, and mining claims that had no legal standing, and railway stocks which had been uttered by men without proper authority to issue them, and stolen bonds, and in a thousand ways have paid their money and had no choice but to consider their loss the purchase price of dear experience. It remained for farmers to demand of Congress a special law for their protection, to shift the burden of their unwisdom to the shoulders of the rightful owners of what they thought they were buying.

THE ATCHISON, TOPEKA AND SANTA FE RAILROAD OVER THE RATON MOUNTAINS.

The railroad over the Raton Mountains, of standard 4' 8½" gauge, is a branch of the Atchison, Topeka and Santa Fé Railroad, under the names of Pueblo and Arkansas Valley, in Colorado, and New Mexico and Southern Pacific, in the Territory of New Mexico. The Ratons, a spur of the Sangre de Christo range, culminate in Raton (or Fisher's) Peak, 9,800 feet above the level of the sea, while the summit of Raton's Pass is reached by the grade line at an elevation of 7,720 feet above the same plane. The following details of grade and curvature are condensed from a paper read by Mr. James D. Burr before the American Society of Civil Engineers:

From La Junta, Col., to Trinidad, a distance of 81 miles, maximum ascending grades of 60 feet per mile have been used, with adverse grades of 30 feet per mile. Curves of 1,146 feet radius are used, with a compensation or reduction of grades on curves at the rate of 0·05 foot each 100 feet for each degree of curvature. Between La Junta and Trinidad there are but three short planes of descending gradients of any considerable moment. In order to locate a line on 60 feet ascending grades to the north, from La Junta to Trinidad—compared with the location of the Kansas Pacific surveys made in 1871–9 on 70 feet maximum gradients each way—a loss of 3,000 feet in distance was sustained. From Trinidad the line follows the valley of the Purgatoire; thence, turning sharply to the south, it ascends the northern slope of the mountain proper by Raton Cañon, on two planes. The first plane, from the mouth of Raton Creek to Morley, 8 miles, is nearly a uniform ascent of 105·6 feet per mile. At Morley, with an elevation of 6,727 feet above tide water, a water tank, turn table, etc., have been established. At the south end of this grade the second inclined plane commences, having 3·5 per cent maximum grades. Between Morley and Summit there are 3 miles of maximum supported grade. The average ascent is 151·4 feet per mile.

The summit is passed by a tunnel, which will be 2,011 feet long. At the south portal of this, 7,584 feet above the sea, the line commences to descend the southern slope of the mountain, on 3·32 per cent maximum gradients, to Willow Springs, which has an elevation of 6,395 feet above tide, having made a descent of 990 feet in 38,400 feet, or a uniform gradient of 2·58 per cent. On the mountain division, from Trinidad to Willow Springs, maximum curves of 573·7 feet radius are freely used. Maximum grades are compensated for curvature at a rate of 0·05 feet per degree of curvature, each 100 feet. The outer rail has been elevated at the rate of ½ inch per degree of curvature. From Willow Springs to Las Vegas, 110 miles beyond, the line has been located on 70 foot maximum gradients, with 6° curves from maximum curvature.

The excavation at each end of the tunnel being very deep, 56 feet at the north portal and 50 feet at the south end, mostly in solid rock, a shaft near the south portal was begun on June 1. The shaft reached the roof of the tunnel section July 9. Up to August 31 the track had reached a point 65 miles south of La Junta, and it became evident that the completion of the tunnel must be hastened or a temporary track built over the mountains to avoid delay. It was, therefore, decided to build the mountain track, and a location for a "switch-back" was made at once. Before the close of December, 1878, the track had been laid, and the work of transporting material for the construction of 118 miles of the N. M. and S. P. Railroad began. At first the switch back was operated by the ordinary eight-wheeled American engines, with 17 inch by 24 inch cylinders, 60 inch driving wheels, weighing about 35 tons; but the advent of the "Uncle Dick," a "consolidation" eight wheeled connected engine from the Baldwin shops, revolutionized transportation on the "Mountain Top" line.

The ordinary round trip, 5½ miles, requires 30 minutes. The ordinary train consists of 7 loaded cars, of 48,000 pounds each; tank of coal, 44,000 pounds; and engine, say 120,000 pounds. Eight loaded cars can be taken over at one time quite readily, and at one time 9 loaded cars were taken at one trip, so that during the day of ten hours 6,000,000 pounds could very readily be moved over the mountain with one engine. The capacity of engines of this class is more than double that of the two engines of 16 inch by 24 inch cylinders, while the quantity of coal consumed is but little more than that consumed by a single light engine. As to controlling trains on these steep inclines it is a question of brake and adhesion to the rail. Under fair conditions of rail one single hand brake to each car, together with the driver and tank brake, with three brakemen to a train of eight cars, is sufficient for safety, unless the train should acquire a speed of 18 to 20 miles per hour, in which event all the wheels in the train might be skidded far enough to lead to disaster. In the "Uncle Dick" this is reduced to a minimum; for, as sand can be delivered along the rails in front of all the wheels, and two sets of air brakes may act on all drivers simultaneously with sufficient force to slide all the wheels, the maximum of adhesion is obtained.

DR. DANIEL DRAPER'S CONTRIBUTIONS TO METEOROLOGY.

In his report as Director of the New York Meteorological Observatory, for 1878, Dr. Daniel Draper takes occasion to review briefly the work done by him in the observatory during the ten years since it was founded and placed in his charge. The high value of this work can be fully appreciated only by those familiar with the influence which his inventions have had in promoting the constant and exact recording of weather changes by automatic apparatus, and the important bearing which his special studies of climate have had on the recent rapid progress of the science of meteorology.

These studies have been serviceable in two directions—in correcting popular errors with regard to climatic changes, and in solving great problems in connection with the general sweep and movement of atmospheric changes.

Of the former sort may be mentioned the researches proving that, contrary to popular impression, the clearing of land does not diminish the fall of rain; that the climate of the Atlantic States is not undergoing appreciable change; and that, considered in periods of five years, the summer temperature of the United States has not undergone any modification.

Of the latter sort are the determination of the great law that a very large proportion of the atmospheric fluctuations of the United States cross the country from west to east; that these fluctuations continue across the Atlantic, and that the time of their arrival on the European coast may be predicted. It is on the basis of these studies that the successful prediction of the arrival of American storms in Europe has been made possible, an achievement of the highest scientific and practical value.

In the meantime Dr. Draper has, as already remarked, invented and improved a variety of meteorological apparatus by which the work of meteorological observation has been turned over to automatic machinery, and the records of atmospheric fluctuations made continuous and unerringly accurate. The several pieces of apparatus employed in the observatory are minutely described by Dr. Draper in his report, and the descriptions, with engravings, appear in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

The entire outfit of a working observatory is covered by

seven pieces of apparatus: 1. Barometer; 2. Dry and wet metallic thermometers; 3. Sun thermometer; 4. Instrument for recording the direction of wind; 5. Instrument for recording the velocity of wind; 6. Instrument for recording the force of wind; 7. Rain gauge.

For the most part these instruments can be fashioned and set up by any bright boy; and we can imagine no occupation more agreeable and profitable during these long winter evenings, or the leisure days which are so common in winter, than their construction and erection in the garret, the barn, or the shop-loft. There certainly can be no more direct or enjoyable method of beginning the study of the fascinating and always profitable science of the weather. If the student has any mechanical skill the simple clock-work employed in some of the pieces of apparatus can be easily made; the cheap machinery of a "dollar clock" can be purchased almost anywhere by such as do not choose to attempt this part of the work. In each case the method of making and using the instrument is given with such minuteness of detail that no intelligent person need be afraid of undertaking the practical study of meteorology by means of them, making if he will every part of his observatory. A very little daily attention thereafter will make the intelligent possessor of such apparatus weather-wise beyond the wildest imagination of the old-fashioned oracle, even though he be the much-quoted "oldest inhabitant."

It may serve as an encouragement to those who may contemplate the practical study of the weather by the means indicated, to say that the inventor of the apparatus described made with his own hands the several pieces he employs; and that by their use he has made the New York Observatory, though housed in a little garret room at the top of the old Arsenal building in Central Park, one of the most efficient meteorological observatories in the world. It is to be hoped that the construction of a new building for his use on some elevated part of the park, where instruments can be placed for the taking of sun spots, earth magnetisms, earth temperatures, and so on, may not be longer delayed.

TRADE MARKS IN CONGRESS.

The proposed constitutional amendment giving Congress the power to grant, protect, and regulate the exclusive right to adopt and use trade marks was reported back from the Committee on Manufactures, December 17, with their unanimous approval, and referred to the Committee on the Judiciary. The Committee on Manufactures expressed a strong desire that the resolution might be agreed to by Congress early in the session, that the amendment might be submitted to the State legislatures in session this winter, as a number of them would not meet again for two years.

The committee urge the necessity of protecting trade marks for the benefit of purchasers, as well as for the encouragement of manufacturers. They insist, also, that the control of the matter should be vested in Congress. Trade marks are not and cannot be confined to State lines; and the treaty-making power, of which this has become an incident, is one solely within national control. The fact that other nations—Great Britain, Germany, France, Belgium, Spain, Russia, and others—have made trade marks a subject of national interest, is further urged as a reason for our following their example.

Undoubtedly a wisely drawn national trade mark law would greatly simplify the regulation of trade marks, and in many ways be a benefit to trade. It is obvious, however, that a law presenting the obnoxious features of the one now declared unconstitutional would not and should not so meet the approval of the several States as to induce them to surrender to the general government their reserved rights in this matter.

The provisions of the law of 1870 with regard to the fraudulent use or counterfeiting of trade marks were quite sufficient. The party misusing a trade mark was made liable to an action for damages; and the party aggrieved was entitled to have his remedy according to the course of equity to enjoin the wrongful use of his trade mark and to recover compensation therefor in any court having jurisdiction over the person offending. In 1876 Congress saw fit to pass an act for the special punishment of trade mark offenders, which put the matter on an entirely different footing. It provided a maximum fine of one thousand dollars or two years' imprisonment, or both, for offering for sale goods bearing a fraudulent trade mark; for affixing such a mark; for putting up packages bearing such a mark; for manufacturing such a mark, or having in possession the means employed in such manufacture, such as dies, brands, engravings, or the like; for in any way dealing in or having in possession any representation, likeness, similitude, copy, or colorable imitation of any private label, trade mark, or the like; for having in possession any used or empty box, envelope, wrapper, case, bottle, or other package to which is affixed a trade mark which might have been obliterated but had not been, so as to prevent its fraudulent use.

The power which such provisions put into the hands of vindictive men to harass or injure their rivals was as unjust and as unreasonable as the punishment provided was excessive. But this was not the worst feature of the law. In one sentence—three yards long, carpenter's measure—section 7 provided that if the owner of any registered trade mark or his agent were to make oath that he had reason to believe that any one was offending in any of the particulars given above, either of the judges of the Circuit or District courts of the United States, or the commissioners of the Circuit courts, were empowered to issue search warrants directing the United States marshal for that district to invade the suspected party's premises and seize any suspected article—as, for example, an empty match box or gin bottle bearing a fraudulent trade mark, or a genuine mark which might have been but was not obliterated. And any one who should knowingly aid or abet any one in violating any of the provisions specified was, in section 8, made liable to a fine of five hundred dollars, one year's imprisonment, or both.

It is safe to predict that the legislatures of the several States will be little likely to put it in the power of Congress to repeat such enactments, even should the proposed amendment to that effect be favorably considered by the Houses now in session.

A more favorable method of securing all that is necessary with regard to the national registry and protection of trade marks is offered in Mr. Caswell's bill, introduced in the House, December 15. This bill embodies the idea set forth by Mr. Bartlett in our issue of last week, namely, that the Commissioner of Internal Revenue be empowered to furnish at a nominal price, to such as may desire the incidental protection thereby afforded, a special revenue stamp, to be known as a trade mark stamp, the fraudulent use or counterfeiting of which would be punishable after the manner of other offenses against the revenue laws. The objections to this method were sufficiently stated by us last week. Its advantages are obvious, not the least of which is the simplicity of its working and the absence of any necessary surrenders of State rights to the general government.

The disposition to hurry the action of Congress in this matter, manifested by the Committee on Manufactures, is much to be deprecated. The existence of State regulations substantially protecting the rights of manufacturers in the matter of trade marks largely removes the alleged urgency of the case, so that immediate action is not so much needed as a permanent and practical settlement of the question on a basis of justice and sound policy. The advantages of the trade mark system are not so great as to warrant any invasion of the just rights and privileges of the people to secure them.

It must not be forgotten that the theory of the protection of purchasers by trade marks, so strongly urged by the committee on manufactures, holds good only so long as the owners of trade marks choose to maintain the original quality of the wares in connection with which the marks acquired their value. But the public have no guarantee that such will be the case, or that the confidence they repose in any mark may not be grossly abused by the original owner or some subsequent purchaser of it. Practically, therefore, the benefit arising from the protection of trade marks accrues chiefly if not entirely to the owners of them. If trade marks were granted only in cases of positive superiority on the part of the wares to be marked, as a sort of reward of merit for real excellence, their influence so far as purchasers are concerned would be vastly different; and the standing of the trade mark owner before the people would be to some degree comparable with that of the patentee. As the matter stands there can be no comparison between them. As a rule, neither the trade mark nor the thing marked adds anything new or valuable to the common stock either of useful ideas or material goods. Yet under the old law, as we have seen, a greater degree of protection was accorded to the owner of a trade mark than to the owner of a patent for invention; a national cheapening of the value of original and useful ideas that should be avoided in future legislation. It is neither just nor politic to place the man who, originating nothing, simply appropriates for his own use something from the common stock of words, phrases, or forms, on a higher level before the law than the man whose thought and labor had created something of public benefit through the advancement of the useful arts.

Under proper restrictions a national trade mark law, as already said, might be desirable. The matter, however, should not be over-hastily considered, either in Congress or in the State legislatures, should it be referred to them. And the subject should be treated with especial caution at this time, when public sentiment is so ill-disposed toward anything partaking of the nature of monopoly, or looking like an unnecessary surrender of rights and privileges either to the national government or to individuals.

A DISSERTATION BUREAU.

About eight years since considerable commotion was created at home and abroad by a published statement that a certain legally chartered medical college in Philadelphia was *selling degrees*. The rumor proved true, and the institution was suppressed. It is, however, a fact that at that very time one of the smaller German universities was conferring degrees upon men who had never seen a German university, without even the formality of their visiting that country, much less of submitting to an examination. Bad as this was, the said institution required, as nearly all German institutions now do, an original investigation, the results and details of which were to be presented in the form of a dissertation.

Recently Berlin has been greatly disturbed by the discovery in that city of a large dissertation factory conducted by one Doctor (?) Rosenbaum, who also gave private lessons and coached candidates for examination. The authorities have succeeded in securing the books and correspondence of this curious establishment, and found that it had been widely and extensively patronized. Strange as it may seem, the dissertations furnished were not merely articles copied from an encyclopedia, but really scientific productions, showing that brains and talent were engaged in this nefarious swindling scheme. The charge for a doctor's dissertation was only $112.50, while small papers were furnished for $37.50. Every profession was represented, for the bureau supplied dissertations in jurisprudence, medicine, philosophy, history, philology, and theology. Owing to the judicial investigation now in progress many details are withheld for the present. It is thought that an investigation will result in degrading a number of persons who have gained their promotion by virtue of these false papers.

The discovery of so deep and dangerous a plan of systematic educational swindling among the honest Germans should lead them to be more lenient toward us for our sharp Yankee tricks and incite us to suppress our own factories of bogus or worthless degrees, that we may be more blameless than vaunted Germany. Our medical colleges especially should be closely watched in the matter of giving degrees. The title, too, of professor, should be more sparingly applied to second rate teachers, and made to mean something.

INFLUENCE OF ELECTRICITY ON VEGETATION.

Some months ago, says *La Nature*, M. Grandeau, director of the agricultural station at Nancy, announced that experiments made upon Indian corn and tobacco proved that atmospheric electricity exercises a very favorable influence upon vegetation. M. Maudin, director of the National Botanical Garden of Antibes, to-day makes known some facts which go to prove directly the opposite. He experimented on other plants, and in another climate; and, as will be seen, he draws the conclusion that M. Grandeau's inferences were too general. According to him, atmospheric electricity, like all other agents of vegetation, plays a useful part, but which, in its absence, can be replaced by another force. The experiment was made in the following manner.

In a kitchen garden bed well exposed to the light, two squares of 51 decimeters each were selected at 7 meters apart, and in each of them was planted a bunch of dwarf kidney beans, a lettuce, a tomato plant, and two cotton seeds. One of the beds was left to itself, and the other was covered with an iron cage, the four uprights of which terminated in points to attract all of the atmospheric electricity. For a fortnight the two cultures appeared to be alike; but at the end of this period, a difference was observed between them, and the difference, which was to the advantage of the cage, kept increasing more and more. The bean plants under the cage were much better developed and much richer in seeds than those in the open air. As for the lettuce, its height in open air was 1 meter, and under the cage, 1·20 meters; its total weight was 337 grammes in the open air, and 427 grammes under the cage. The tomato plant in the open air had attained a height of 0·8 of a meter, and under the cage, 1 meter; its weight in open air was 0·072 of a kilogramme, and under the cage, 3·754 kilogrammes. While under the cage the plant bore 88 tomatoes, weighing 2·162 kilogrammes, the number on the plant in the open air was only 37, with a weight of 1·08 kilogrammes.

THE COMMON REWARD OF INTELLIGENCE AND ENERGY.

The *Recorder*, of Americus, Georgia, reports the case of a farmer, near that place, whose experience shows very clearly what there is in the common Southern complaint that farming cannot be made to pay in the South. Of this man the *Recorder* says:

"He began life since the war, a poor young man, as a farm hand, working for wages. He has inherited nothing, and has been engaged in no business except farming. He, this year, will make 90 bales of cotton, has not brought a single bale to market, does not propose to sell a bale before spring, and he is able to hold it. He owns one of the best plantations in Southwest Georgia, and it is his boast that he buys nothing upon which to feed man or beast, except sugar and coffee, but, on the contrary, has something to sell of almost any product of Southern soil. Last year he made 1,600 gallons of sirup, and this year has sold over 200 pounds of butter."

If such examples are rare in the South—as they probably are in too many parts of our country—the fault lies more in the men than in their surroundings. There is no part of the settled portions of the United States so poor in natural advantages and opportunities that men of intelligence, pluck, and energy, cannot win therein, if they will, a fortune which, in comparison with that of their less enterprising neighbors, may seem phenomenal.

Animal Rubber.

An insect, which produces a species of India-rubber, has been recently discovered in the district of Yucatan, Central America, by an American explorer. It is called *neen*, and belongs to the Coccus family; feeds on the mango tree, and swarms in these regions. It is of considerable size, yellowish brown in color, and emits a peculiar oily odor. The body of the insect contains a large proportion of grease, which is highly prized by the natives for applying to the skin on account of its medicinal properties. When exposed to great heat the lighter oils of the grease volatilize, leaving a tough wax, which resembles shellac, and may be used for making varnish or lacquer. When burnt this wax, it is said, produces a thick semi-fluid mass, like a solution of India rubber.

THE SECOND AVENUE ELEVATED ROAD.—The first train was run over the Second Avenue Elevated Railway, December 15.

The Detroit River Problem.

A board of engineer officers, under orders from the War Department, have been making inquiries with regard to the proper means of solving the transportation problems that have arisen at Detroit, Mich. Briefly stated the difficulties to be overcome and the interests to be reconciled are these:

At Detroit two immense streams of commerce come into direct interference, namely, one by water and the other by railroads. The problem before the Board was to so arrange by either bridge or tunnel that these might cross each other with the least injury to both, and in such manner as to accommodate the railroad traffic, and at the same time do no material or undue injury to the interests of navigation. The magnitude of these conflicting interests at this point may be realized from official statements, which show that the number of vessels of various kinds passing Fort Gratiot lighthouse during the fiscal year ending June 30, 1879, was 22,150, and that the business of the railroads crossing the river at Detroit during the year 1878 was as follows: 129,113 passengers, 12,258 passenger cars, 3,673 baggage cars, and 104,359 freight cars.

The board are unanimously of the opinion that a tunnel under the river offers the most complete solution of the problem. They, however, indorse the bridge plan conditionally. A former board of examiners reported against a bridge project which contemplated draw openings of 166 feet. The present board regard a bridge more favorably in consideration of the facts that draws of more than 200 feet have been since constructed, and that it is now proposed by bridge builders of high reputation to construct them with openings of 300 feet on each side of a pivot pier, or of 400 feet between two pivot piers. With such a bridge they hold that with the present traffic there will be ample time during the intervals between the passage of vessels to move all trains across the bridge. There will occasionally be delays, but the railroads can accommodate their time tables to compensate for any ordinary delays. They say, however, that in case authority to construct a bridge should be granted by Congress it should be distinctly provided that vessels have the right of way, except when moving trains are passing over the bridge.

Cotton and Corn.

The report of the Department of Agriculture as to the condition of the cotton and corn crops, Dec. 15, shows that owing to favorable weather in all parts of the cotton belt the crop will be somewhat better than was previously reported. Imperfect ripening in some of the Northern States slightly reduces the average yield of corn per acre. The figures still leave the corn crop larger than that of any previous year by 150,000,000 bushels. The States and Territories west of the Mississippi River return over 100,000,000 bushels more than in 1878.

HORIZONTAL DOUBLE-ACTING FORCE PUMP.

We give herewith an engraving of a very substantial and efficient force pump made by the well known Goulds Manufacturing Company of Seneca Falls, N. Y. It is intended for feeding boilers, elevating water, and for other purposes requiring a first class pump.

The working parts of the pump are all brass. The cylinder is brass lined, and by unscrewing the brass nuts at the side, both the upper and lower valves are accessible, without disconnecting either the suction or discharge pipes. The gears are cut, and are six inches and sixteen inches diameter respectively. The relative sizes of these gears may be changed if desired, arranging them so as to work against a very heavy pressure, or to run faster, against lighter pressure. The connecting rod has strap joints with gib and key, and with brass boxes. The crosshead runs on two substantial guides, taking all the lateral pressure from the stuffing box and piston, and at the same time forming a brace from the pump cylinder to the pillow blocks. The pulleys are eighteen inches diameter and five inches face, and have an outside bearing. The frame is all cast iron (weighing over 700 lb.), very heavy and strong, occupying a space five feet long by two feet three inches wide—at the pulleys three feet three inches wide. The whole pump weighs about 1,000 lb. The pulleys may be run at from 120 to 160 revolutions, which would give 90 to 120 strokes of pump respectively. For continuous work the less speed is the best for the economical working of the pump. When used for fire protection it may be run at the higher rate of speed.

THE GOULDS DOUBLE-ACTING FORCE PUMP.

A Use for Blast Furnace Cinder.

The following method of utilizing blast furnace cinder in jacketing steam pipes is recommended by Mr. Franz Buttgenbach: Mix 150 parts of cinder dust, 35 parts by weight of fine coal dust, 250 parts of fire clay, and 300 parts flue dust, with 10 parts of cows' hair, add 600 parts of water, into which 10 or 15 parts of raw sulphuric acid has been poured, and make a stiff dough of the whole. This is thrown in small amounts upon the warmed pipe, hardening rapidly. Upon this rough coat a second, third, etc., is laid, according to the thickness which is to be used. By the action of sulphuric acid, gypsum is formed, and the silica, rendered free, hardens. The mass becomes as hard as porcelain, and is still porous. It adheres firmly, and never cracks. Mr. Buttgenbach states that he has tested its merits by ten years' use, and has found it to meet all requirements.

GOPHER AND ANT DESTROYER.

The California ground squirrel, commonly known as the gopher, is a great pest to the farmer, destroying enormous

MELCHER'S GOPHER AND ANT DESTROYER.

quantities of grain and doing great injury to gardens and orchards. The cutting ants which infest many of the Southern States and parts of California and Mexico, and the moles which are found in various parts of the country, are all enemies to the agriculturist, and destroy millions of dollars' worth of crops every year.

The accompanying engraving represents a novel and effective gopher and ant destroying apparatus, patented by Mr. John C. Melcher, of O'Quin (Black Jack Springs P. O.), Texas. It consists in a fire chamber, having around the bottom a sharp flange which cuts into the ground around the ant or animal hole, forming a tight joint. The fire chamber has an air space under the grate, which communicates with the air forcing pump through a short section of flexible tube. An internal pipe extends from the bottom of the fire chamber upward to convey the poisonous fumes from the top of the chamber down into the chamber formed by the flange.

A fire having been made in the fire chamber, the poisonous compound is dropped in upon it, and the opening in the top of the chamber is closed. The air-forcing machine being started, all of the smoke and poisonous vapors are forced down into the hole, killing everything animate with which it comes into contact.

The Need of Mechanical Industries in the South.

Commenting upon the general need of new industries in the Southern States, the New Orleans *Times* says:

One often hears the remark that the South is slow to take up manufactures which will, undoubtedly, add millions to her wealth, and provide employment for thousands of hands that now perforce are idle. But it must be remembered that, previous to the civil war, the attention of the Southern people was concentrated upon agriculture, which paid, or was supposed to pay, a magnificent profit. The war demonstrated better than anything else could have done the inherent weakness of a people whose entire reliance is placed on one branch of industry. The growth of Southern manufactures has since been slow but steady.

In looking around one finds innumerable articles which were formerly imported now made at home. The magnificent machinery used to take off the sugar crop is now made in New Orleans. And the same is true of many other branches of industry. Cotton manufacturing now, for the first time, comes forward under really favorable auspices, and it is not unreasonable to suppose that it will progress as similar industries have done.

New Orleans has a large population which could furnish the very best class of skilled labor. Our people have all the aptness and taste which they inherit from the Latin race. The great problem we must face is how to convert this large mass of people, who are idlers from the force of circumstances, into bread-winners, adding health and vigor to the community.

A Rise in Rubber.

Owing to reports of a partial failure of the rubber crop of Brazil, and the clever management of speculators at Para, the price of rubber was forced from 50 cents to one dollar a pound during the second week in December. During the excitement it is said that in one day several houses in New York and Liverpool bought 2,000,000 lb. of rubber at prices ranging from 75 to 80 cents a pound. Though the report of a short crop was strenuously disputed the price continued far above its natural level. The Para district produces about half the rubber crop of the world, or from 15,000,000 to 18,000,000 lb., the other half coming from Africa and the East Indies.

ENGINEERING INVENTIONS.

Mr. Seth C. Doyle, of Harrisonville, Mo., has patented an improvement in the class of couplings in which a swinging link is raised and held in horizontal position for engagement with the drawhead of an opposite car by means of a lever which is attached to the same car as the link.

Messrs. James B. O'Donnell and William J. Dever, of Hazleton, Pa., have patented a brake that can be easily applied to coal or freight cars, gondolas, oil cars, and the like. It is operated by the contact of one car with another.

Mr. Gustave J. Crikelair, of New York city, has patented an improved apparatus for elevating water above the height to which it would naturally rise, by the combined action of gravity and compressed air.

An improved water elevator, patented by Mr. Robert M. Catlin, of Tuscarora, Nev., relates to apparatus for raising water by compressed air, and the apparatus is especially intended for use in mines as a substitute for pumps. The use of pumps for that purpose is open to many objections and disadvantages, such as loss of power from friction, and by reason of the distance the plungers are placed from the motor, the disarrangement of valves and other mechanism, and the cutting out of the piston heads and cylinders by the grit contained in the water.

Mr. Samuel S. Burt, of Marquette, Mich., has invented an improvement in elevated railways. It pertains, first, to securing the track rails upon ties which are so constructed that their ends are made elastic, thus adapting them to yield when a train passes over the road. The manner of construction adopted to secure the requisite elasticity is to slot the ends of the ties and insert rubber blocks between the posts separated by the slot.

Mr. John M. Cayce, of Thompson's Station, Tenn., has patented a motor designed to operate without weights, springs, magnetism, or expansive gas, which he calls the "hydro-buoyant motor," for the reason that it takes advantage of the buoyant value of a float contained in a body of water. It consists in arranging the float in a receptacle filled with water in such a manner that the float is free to rise, and in rising shall communicate its power to extraneous mechanism, the operation being made continuous by reversing the position of the receptacle containing water, which gives a renewed position to the float, from which it may again rise.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR JANUARY, 1880.

Mercury.

On January 1 Mercury rises at 5h. 49m. A. M., and sets at 3h. 5m. P. M.

On January 31 Mercury rises at 6h. 58m. A. M., and sets at 4h. 12m. P. M.

Mercury will be near the waning moon on the morning of the 10th.

Venus.

Venus rises on January 1 at 3h. 56m. A. M., and sets at 1h. 53m. P. M.

On January 31 Venus rises at 4h. 47m. A. M., and sets at 2h. P. M.

Venus, although less brilliant than in December, will yet be very beautiful in the early mornings of January, and on the 8th may be seen north of the waning moon.

Mars.

On January 1 Mars rises at 7m. after noon, and sets at 3h. 10m. the next morning.

On January 31 Mars rises at 11h. 24m. A. M., and sets at 2h. the next morning.

Mars is easily known by its reddish tint; it is among the stars of Aries, and on the 20th will have the same right ascension with the moon, and be $2\frac{1}{2}°$ south of the moon in declination. The satellites of Mars are so small that only the largest telescopes will show them. They are exceeding difficult objects even with a glass of 12 inches diameter.

An ordinary telescope with an object glass of 3 inches diameter will show markings on the surface of Mars, and the whiteness of the polar regions.

Jupiter.

Jupiter sets early in January, and is farther from us than in the Autumn.

On January 1 it sets at 9h. 28m. P. M., and on the 31st it sets at 8h. 1m. P. M.

Observations upon it must be made between 6 and 7 P. M.

During that hour the first satellite will disappear on the 6th by going behind the planet; on the 7th, will reappear from transit; on the 14th, will be invisible, because in transit; on the 15th, will come out of shadow; and on the 30th, be seen to pass from the face of Jupiter. During that hour the second, or smallest moon, will reappear from transit on the 4th; will be in transit on the 11th; and behind the planet on the 27th.

On the 14th the largest moon will pass off from the face of Jupiter between 6 and 7 P. M.

On the 8th the most remote of Jupiter's moons will be in transit between 6 and 7 P. M. On the 25th this moon will pass from the disk.

On the 21st, between 7 and 8 P. M., the first satellite, or that nearest Jupiter, and the third, which is the largest, will enter upon the disk of Jupiter nearly together; if the planet is not too near the horizon this will be a very interesting sight.

Saturn.

The large planets are all becoming more distant.

On January 1 Saturn sets just before midnight; on the 31st it sets at 10h. 11m. P. M.

Saturn will have the same right ascension as the moon on the 17th, and will be $8\frac{3}{4}°$ lower in declination.

Although small telescopes will show the two satellites, Titan and Rhea, when Saturn is in its best position, probably Titan only can be seen during January. It should be looked for early in January on the west of Saturn as seen in the telescope.

Uranus.

Uranus is coming into better position. It is very remote, and appears only as a very small greenish white moon, when seen in the field of the telescope. It is still near the star λ Leonis, but by a retrograde motion it passes that star and will be found late in the month west of it and 2° south of it in declination.

Neptune.

On January 1 Neptune rises about 1h P. M., and sets at 2h. 33m. A. M. of the next day.

On January 31 Neptune rises at 11h. 1m. A. M., and sets 35m. after midnight.

On the 1st Neptune passes the meridian about 13m. before Mars, and is 5° south of Mars.

A Novel Theory as to the Origin of Diamonds.

One of Dr. W. B. Fletcher's frogs escaped from his frogarium some time ago, and was found the other day behind a register at his office starved to death and shrunk to half its former dimensions. The doctor dissected it, and coming to its lungs found these organs clogged with thousands of black crystals which looked like coarse gunpowder. Under the microscope those crystals presented regular facets with smooth surfaces, presenting the same angle of crystallization as the diamond. On burning they gave off carbonic acid gas, and they are pure crystals of carbon, as the diamond is. According to the Indianapolis *Herald*, the doctor ingeniously theorizes that in the ages gone by the huge reptiles of the antediluvian period, dying under circumstances similar to those under which the frog did, may have formed large crystals of carbon in their lungs which were afterward transformed into the hard and lustrous diamond.

NOVEL HAT SWEAT.

We give herewith an engraving of an improved hat sweat lately patented by Mr. Caesar Simis, of No. 10 Broadway, New York. The sweat has two rows of ventilating holes connected by transverse slits, and along the back of the sweat there is an elastic band which presses the slotted portion inward, making it convex and diminishing the size of the hat. The slits may extend entirely around the sweat, or they may be formed in the front part only, as may be desired.

By means of this improvement two important advantages are secured, which will be appreciated by both hat dealers

1.

2.

IMPROVED HAT SWEAT.

and hat wearers. One advantage is that of the most perfect and thorough ventilation of the hat; the other is the adaptability of the leather to any shape or to any pressure brought to bear upon it by the head. In fact it converts the hat into a perfect "conformator," avoiding the usual fitting and shaping of stiff hats, and saving a great amount of time, labor, and expense. A stiff hat provided with a sweat of this kind is much more comfortable to the wearer than an ordinary soft hat.

To the hat manufacturers this invention is of great importance, as it obviates the necessity of using so many different sizes of blocks, as the hat provided with this improved leather or sweat will answer for two, and in some cases three different sizes of heads. For the same reason it is of great value to the retailers.

IMPROVEMENT IN EYE-GLASSES.

The engraving represents an improvement in nose clamps for eye-glasses recently patented by Mr. Alonzo C. Blethen, of Lynn, Mass.

BLETHEN'S IMPROVEMENT IN EYE-GLASSES.

The frame of the glass is of the usual form, and the attachment consists of a clip having at its ends hooks for engaging the projecting edge of the frame. A short piece of small elastic tubing is stretched over the clip, and forms a yielding surface, which affords a firm hold upon the nose without being uncomfortable to the wearer.

This improvement will be appreciated by those who have worn the ordinary glasses with ribbed or serrated edges, as it does away with the irritation and discomfort caused by a continual pressure of such a surface upon the nose.

Further information in regard to this improvement will be furnished by the inventor on application.

Moulding Mixture for Gelatine Photo-Plates.

For moulding the gelatine relief Leipold's mixture may be employed, and by the exercise of care very perfect results may be obtained. The following receipt for Leipold's mixture is taken from Husnik's *Heliographie:*

Seventy parts of bitumen are melted at a moderate heat, and to the melted bitumen there are added the following, each being melted previously: 425 of spermaceti, 200 of stearine, and 170 of white wax. All these being well incorporated, 70 parts of finely ground blacklead are stirred in. The plate to be moulded being thoroughly swelled, is removed from the water, dried with a cloth, and gradually raised to as high a temperature as it will bear without injury to any details of the device, this being generally about 35° C. A metal border being now fixed round the edges, the above composition, which ought not to be at a higher temperature than 40° C., is poured on, the composition being allowed to flow over the plate in one continuous wave. The thickness of the layer of composition may vary from half-an-inch to one inch in thickness, according to the size of the plate, and no attempt should be made to remove the cast until the next day, when it will generally separate with great ease. The mould is next made conducting with bronze powder, and electrotyped. The first electrotype cast obtained should be very slightly oiled, and a second cast made in it will be the required printing plate.

Curious Speculation Concerning Electrical Action in the Human Body.

At a recent meeting of the London Physical Society Dr. Shettle read a paper on the "Influence of Heat upon certain forms of Induction Coils, considered more especially in relation to the Inductive Power which the Blood Exercises on the Various Structures of the Body." The author found that when a copper and zinc wire were insulated from each other by parchment paper and paraffined silk, and wound in close proximity to each other, a (induced) current was indicated on a galvanometer whose terminals were connected to the neighboring ends of the zinc and copper wires respectively, the other ends being left free. When the latter were connected across the deflection was nil. On raising the temperature of the two wires by causing hot water to flow inside the coil into which they were wound, the deflection was largely increased. These experiments led Dr. Shettle to imagine that there is a similar action in the animal body. The heart is made up of nerves and muscular fibers winding spirally, and some of these wind round each other so as to form a spiral cord, round which the blood capillaries also wind. Dr. Shettle compares these nerve and muscle bundles to the coils of zinc and copper wire in his experiments, and infers that electric currents may be induced in them as in the wires. The flow of the warm magnetic blood would also tend to produce currents in them. Dr. Shettle further drew attention to the fact that animals live and move in a magnetic field, and that electricity must be generated in them by their movements, internal and external.

FAILURE OF THE IODINE TEST FOR STARCH.—Puchot noticed, in testing a sample of butter suspected of containing starch, that the iodide of starch reaction is impaired by the presence of certain nitrogenous organic substances, among them albumen, whether from milk or eggs.

The Solar System in Miniature.

The London *Times* describes an interesting if not useful invention by an Italian, Signor N. Perini, long a resident of London. For want of a better name it is called a planetarium, though vastly different from anything of that name hitherto constructed.

It is erected in the center of a room of "ordinary size," with a high ceiling. On entering the room one sees a high circular chamber, or box, standing on twelve wooden pillars. On entering underneath this chamber, and looking up, a dome is seen, deep blue, and sprinkled with stars, the chief northern constellations being in their proper places, and round the base of the dome the names of the signs of the zodiac. Pendent from the top of the dome by a narrow tube is an opal globe, lit inside by gas, and representing the sun. From wires, almost invisible, the planets are suspended around the sun, of sizes and at distances approximately proportionate to the real sizes and distances, and each having its proper inclination to the plane of its orbit. The various moons are in their places, and Saturn has his rings. The general effect on looking up at this arrangement from below is impressive, and this effect is increased when Signor Perini, by simply turning a key, sets the system in motion, rapid or slow, as he chooses. The sun turns on his axis and the planets in their orbits, all in time accurately proportionate, and on watching the movements for a short time one easily realizes the immense differences in length of the years of the earth and those of the outer planets. By an ingenious watch-work arrangement inside the earth, which is the size of a walnut, our world is made to revolve on its axis, the latter, by a special effort of ingenuity of Signor Perini, being always made to point to the same quarter of the heavens. The same arrangement causes the moon to revolve round the earth in its own proper orbit. Perhaps the great triumph of this invention is the fact that the planets revolve round the sun in proper elliptical orbits, which are traced around the inside of the dome. The dome is fourteen feet in diameter at its base and fourteen feet high. In the chamber above the dome the machinery invented by Signor Perini is arranged, the details being as yet

secret. The moving power is clock-work, the originality in the arrangement being, we believe, the method by which the inventor effects the elliptical motion of the planet. Not a sound is heard when the machinery is in motion, the whole working in that "solemn silence" which the hymn tells us is characteristic of the starry sky. The inventor could, we believe, make his planetarium of any size, from the dome of St. Paul's to a little thing that might be used for school instruction. Signor Perini has devoted his nights and mornings to this structure for seven years, and has expended upon it something like $3,500; the earth itself, we believe, has cost him $300. We believe he has been prompted to this work solely by the enthusiasm of a mechanician, and by a desire to do something to enable those interested in astronomy to realize, as far as possible, the arrangements of the solar system.

The Clay-Pits of Pennsylvania and Delaware.

The chairman of the Committee on Crude Materials reported to the Potters' Association that the immense deposits of fine, pure kaolin in Chester and Delaware counties, Penn., and across the line, in the State of Delaware, are sufficient, if properly opened and worked scientifically, to supply all the potteries of this country for a century. He adds, however, that the clay mines of this rich region have been thus far opened and worked in the most unscientific, slovenly, and wasteful manner. And the worst feature of all is that what clay they do get out is absolutely spoiled for the finest wares by this slovenly, wasteful process of mining. The system, or rather want of system, upon which these mines have been and are being worked is to open a small, insufficient area at the surface, just to enable them to reach the top of the clay, with an opening too small to enable them to separate the strata and keep the coarse and fine yellow and white clays from being mixed. Then, at every rain-fall, earth, sand, and gravel are washed down the bank into the pit; the sides of the pit cave in and cover all the clay over, then they are compelled to stop, clean out and separate the dirt and clay as best they can. Then they begin to get out clay until another caving in takes place, when all is mixed and turned into confusion again. Some of these pits have been worked over and over so long in this way, and the excavation become so large, and the dirt thrown around so loose, that regular land-slides occur, burying machinery, tools, and clay all in the utmost confusion. It needs no prophet to tell what kind of clay results from this process. There are one or two mines more broadly and better opened, where the different strata could be kept separate, but instead of doing this they systematically mix the white and yellow veins together, by taking alternate tubs of each, which is then washed and sold as best clay. The National Kaolin Company, with a pit in much confusion, under all the disadvantages of land-slides, are, by sharp, personal supervision, and with an evident intention of doing the best they can under the circumstances, getting out some really fine clays. The new mine opened by Major Willauer has been opened on a broader scale than most others, and he promises to immediately clear off a still larger area of superincumbent earth, sufficient to prevent its being washed into the pit among the clays. Then, if the fine white clays are kept separate from the yellow, thus making two grades of clay—*i. e.*, a first and a second quality—a great step will be taken in the right direction, for that is the direction in which our clays must be worked.

A Nitroglycerine Explosion.

A magazine of nitroglycerine and mica powder on Fox Island, opposite Amherstburg, Ontario, exploded December 12. The explosion was felt forty miles away, in Leamington and Ruthven, shaking every house in both towns. At Fletcher, on the Canada Southern Railroad, forty-four miles away, the people ran out of their houses in alarm, the shock was so severely felt.

The cause of the explosion is not known, but it is supposed to have been caused by hunters leaving a fire on the island, which reached the magazine. At the time of the explosion an immense blaze lighted up the whole heavens, the earth trembled, and a tremendous report followed. There were about three tons of nitroglycerine, besides mica powder, in the magazine at the time. Nothing remained of the magazine, a hole 60 feet in diameter and 15 feet deep marking the spot where it stood.

The great Suspension Bridge between New York and Brooklyn.

In a lecture on the Brooklyn bridge, Mr. E. F. Farrington, Master Mechanic of the work, gave some interesting facts in regard to the construction of the bridge. The lecture was illustrated by a large sectional view of the roadway, showing the carriageways and foot-walks on the outside of the roadway, and the two trackways for the cars, that are to be run across the bridge by means of an endless chain. Four high trusses were also displayed, which will run the whole length of the bridge, distributing the weight more evenly and stiffening the structure against the action of the wind. High above the flooring proper will be built a promenade, 15 feet in width, from which pleasure seekers and others may obtain an excellent view. The roadway will be 135 feet above high tide, and its length from tower to tower is 1,595 feet 6 inches. It has two land spans (from the towers to the anchorages) of 930 feet each, and an approach on the Brooklyn side of over 900 feet, and on the New York side of over 1,500 feet. The total length of the bridge will be a little over one and one eighth miles. The suspenders which hang from the cables and support the roadway have enormous strength. The greatest weight which will ever be brought to bear on them is 10 tons apiece, yet they have been tested with a weight of over 140,000 pounds without giving way. There are no such things as rotten wires in this bridge. The first wire was thrown across the East River on the 29d of May, 1877; on the 11th of June following the process of running the wire across began. The process of wrapping the cables was so tedious, that frequently not more than 15 feet was wrapped in a day.

If the requisite funds are not withheld, the completion of the bridge is promised in eighteen months, or the middle of 1881.

NEW MUSICAL INSTRUMENT.

Undoubtedly the happiest households in the land are those in which music forms a part of daily life. It is not necessary to inaugurate a grand concert, nor to employ an orchestra, nor an organ to produce music that is enjoyable, that will render home pleasant, and cultivate tastes of the children and older ones.

The little instrument shown in the accompanying engravings is designed not for anything pretentious, but for home use and pleasure.

Some of the recent improvements in musical instruments have reduced the matter of playing to a mechanical performance, so that with properly prepared sheets any music may be played correctly. The phonographic piano shown in the accompanying engraving is an instrument that can be furnished at a small cost, and will play any tune in a purely mechanical manner, something on the principle of the wonderful phonograph.

FIG. 1.

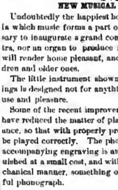
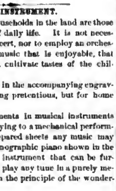


FIG. 2.



PHONOGRAPHIC UPRIGHT PIANO.

A child can play it as well as a grown person, and it affords a great deal of amusement to both young and old.

Fig. 1 in the engraving is a front view of the instrument, and Fig. 2 is a rear view, giving an idea of the arrangement of the endless strip of paper in which the tune has been perforated. This strip is inserted between rollers, and the door is closed, when, by turning a small crank, the paper strip is made to move through the instrument and over the key board. The keys or strikers press through the perforations, when the hammers strike the bars and produce music which it is said is clear, loud, and melodious. The instrument does not get out of tune, and it will furnish music for dancing, or an accompaniment for singing. Paper strips may be perforated for any new music and readily applied to the instrument.

The manufacturers of this instrument are the well known Massachusetts Organ Co., 43 Washington street, Boston, Mass., who will furnish further particulars on application.

The Armor of the Polyphemus.

Mr. J. L. Buskett, of St. Louis, Mo., claims that the method of convex armor plating of three inch steel, proposed for the British naval vessel Polyphemus, and described as the invention of Sir George Sartoris, was anticipated by himself several years ago.

Under date of November 26, Mr. Buskett writes as follows: "I had a model made which two years ago I took to Washington City and submitted to several of our principal ordnance officers, who declared the idea to be impracticable. Last June I was again in Washington and called upon Commodore Jeffries, Chief of the Ordnance Department of the Navy, to whom I explained my idea, and he also declared it to be totally impracticable and useless. Being poor and not having money to make the necessary experiments myself, I left my model at the office of A. H. Evans, Esq., and for the time being abandoned all hope of having it tested by our government.

"Judging from the meager description in the article referred to, I am inclined to think my invention was not only first conceived, but is superior to that of Sir George Sartoris, in that in mine the plates are not only convex, but are also circular in form, and each one fastened to the vessel by a single round bolt passing through the center, so that the *plate is set in motion at the moment of impact, and the deflection of the missile made certain.*"

New Steamers.

The Compagnie Générale Transatlantique, one of the largest French steamship companies, has lately given an order for the construction of several large steamers to four English shipbuilders, and this fact has excited considerable indignation in French mercantile circles. The president of the company has addressed a letter to a French journal explaining the circumstances under which the order was intrusted to English instead of to French hands, and stating the following interesting facts. The vessels were required to be delivered in eight months, and when estimates were invited from the principal French shipbuilders they all, with one exception, declined to tender on the ground that the time allowed was too short. The Société des Forges et Chantiers du Havre et Marseilles offered to build six vessels at 1,400,000 francs (£56,000) each, and to deliver the first in ten months and a half, the second in twelve months and a half, and the rest in fourteen months. Fourteen English firms tendered, besides several whose offers arrived too late to compete, and four of them agreed to deliver the vessels at an average of 1,139,750 francs each. This is 260,250 francs, or £10,410, less per vessel than the lowest French estimate, and each firm contracted to deliver the vessels within seven months and a half.

MECHANICAL INVENTIONS.

An improved device for stopping horses, patented by Mr. Isaac J. Warner, of Watertown, Conn., consists in mechanism for pulling upon the bit of a horse, constructed so that power may be applied to the mechanism by operating a lever, or from the running gearing of a vehicle, to check and hold the horse should he become frightened or fractious. In the latter case the apparatus works automatically without the presence of the driver. The same device answers for checking and unchecking without alighting from the vehicle. It is also useful in breaking and training colts. It is simple and inexpensive, and does not injure the appearance of the vehicle. The inventor states that it may be applied to sleighs as well as carriages.

Messrs. William E. Jones and Benjamin P. Myers, of Jones' Station, Ohio, have patented an improved carpenters' lever for facilitating the laying of floors, wainscotting, weatherboarding, and especially to overcome the difficulties attending the use of warped and crooked lumber.

Mr. John L. Copp, of Rochester, N. H., has invented an improved buffing machine for boots and shoes. The improvements consist in a swinging standard hung upon a driving shaft, and extending over the bench, to the upper end of which is jointed an arm that carries the sandpapering roll, and is capable of movement to bring the roll to the positions required. The roll is driven, by pulleys and belts, from an intermediate cone pulley on the standard, which is driven by a belt from the driving shaft.

An Advertiser's Experience.

To the Editor of the Scientific American:

Permit me to use a little of your valuable space to give expression to my views of advertising one's business, and the best medium. Some nine years ago, while still in the oil business, I had associated with me as salesmen practical engineers and chemists. Our observations led us to devise some plan whereby we could lubricate the bearings without the great waste of oil and consequent drip. The result was a lubricating compound known as "lubricene," which met every requirement, and reduced the cost of lubrication to its minimum.

We considered ourselves among the benefactors of the human race, and as such looked for our reward. We prepared our machinery, and began manufacturing and sending out samples and salesmen. Every one admitted we had a "good thing," but we found it slow work, and were forced to the conclusion advanced by a successful business man that "the more confidence you have in your goods the more need there is to advertise it." Acting on this hint we got out pamphlets, showcards, etc., but the response was very limited. We then resorted to the different trade journals, and now after these years of experience we are free to say that we have had a far larger return from the SCIENTIFIC AMERICAN than any four other papers combined. We are glad we advertised.

Yours very respectfully,

R. J. CHARD.

6 Burling Slip, New York.

Preservation of Wood.

The improved French method of preserving wood by the application of lime is found to work well. The plan is to pile the planks in a tank, and to put over all a layer of quicklime, which is gradually slaked with water. Timber for mines requires about a week to be thoroughly impregnated, and other wood more or less time, according to its thickness. The material acquires remarkable consistence and hardness, it is stated, on being subjected to this simple process, and the assertion is made that it will never rot. Beech wood prepared in this way for hammers and other tools for ironwork is found to acquire the hardness of oak, without parting with any of its well known elasticity or toughness, and it also lasts longer.—*Amer. Building News.*

The Science of Government.

Commodore Whiting, a century or so ahead of time, has presented to the Senate a memorial asking that body to authorize the President to invite all the governments on this continent to unite in an offensive and defensive confederation. The memorial proposes that each government remain independent in the administration of its own affairs, but be otherwise subordinate to the general government of the confederacy: the general government to have the executive right to declare war, to proclaim peace, to maintain armies and navies, and to regulate commerce.

History of the Cucumber.

A writer in a recent number of the *Science Gossip* says that the cucumber is known to have been cultivated for more than three thousand years. In ancient Egypt it was extensively grown, and so at the present day. The want of this vegetable was one of the grievances complained of to Moses by the Israelites in the Wilderness; we also find it mentioned in other parts of Scripture. It is mentioned in a particular manner by some of the early Greek writers on plants. Cucumbers grown in the neighborhood of Antioch were considered by the ancient Greeks the finest. Columella mentions that the inhabitants of Mendes, in Egypt, were accustomed to take the largest bramble bush they could find, transplant it to a warm, sunny spot, cut it down about the time of the vernal equinox to within a couple of fingers of the ground, then insert a seed into the pith of the bramble, the roots of which were well covered over with fine manure to withstand the cold. By this plan they were enabled to have cucumbers all the year round. This same author states that cucumbers ought to be propagated from seed that has been steeped in milk and honey for a couple of days, this method having the effect of rendering them sweeter and pleasanter to the taste.

Pliny states that in Italy the cucumbers are small, but in some countries are large and of a wax color or black. He tells us that the Emperor Tiberius was so fond of this vegetable that it was served up at his table all the year round. The same author appears to have considered the cucumber unwholesome in an uncooked state, as he tells us it will live in the stomach until the next day, and cannot be reduced to food; but when boiled and served up with oil, vinegar, and honey, it makes a delicate salad; he also recommends a pinch of the seed beaten up with cumin and taken with wine as a good remedy for a cough.

The precise date at which the cucumber was first cultivated in England is unknown. It was probably introduced with other fruits and vegetables at the time the Romans were masters of the country. It became neglected in time and entirely lost, but was at length introduced again at the later part of the reign of Henry VIII. Parkinson, in his "Paradisus" (1656), tells us that in many countries they do eat cucumbers as we do pears and apples, paring and giving slices of them as we would to our friends of some dainty apple or pear. The cucumber was not generally cultivated till almost the middle of the seventeenth century, and it is stated that the first successful forcer of this plant in England was Thomas Fowler, gardener to Sir Nicholas Gould, of Stoke Newington. Some years ago the cucumber was cultivated in large quantities in the outskirts of London, and it is stated in Dr. Wynter's "Curiosities of Civilization," that fourteen acres might be seen under hand glasses in a single domain, and that it has been known that 200,000 gherkins have been cut in a morning for the pickle merchants. In Loudon's time large quantities were grown in the fields of Hertfordshire, without the aid of glass, for the London markets during the summer months. The village of Sandy in Bedfordshire, has been known to furnish 10,000 bushels of gherkins in one week for pickling purposes.

The cucumber, notwithstanding its extensive use, is considered unwholesome by most medical men. Dr. Doran, in his "Table Traits," mentions that in the days of Evelyn (1699) the cucumber was looked upon as only one remove from poison, and adds that it had better be eaten and enjoyed with that opinion in one's memory. Abernethy also gave a quaint recipe for its use, which was to peel the cucumber, slice it, pepper it, putter vinegar to it, then throw it out of the window.

The extent to which this vegetable is consumed by the inhabitants of Egypt and the southwest of Asia, but also in European Russia and Germany, would scarcely seem credible to this country. You never see a Russian peasant at dinner but you see the lump of black bread and a cucumber. The vegetable seems certainly a singular dish to be so national in a country with a climate like that of Russia. Some writers say that there used to be a great annual fair at Leipsic for cucumbers, when the streets were heaped up a story high with that precious element of German cookery. In Germany barrels of half and also full grown cucumbers are preserved from one year to another by immersion in deep wells, where the uniform temperature and exclusion from air seem to be the preserving agents. Tartary has been assigned as the native country of the cucumber, but upon what authority is equally questionable with that of the melon. No modern traveler appears to have found it growing wild.

Ericine, a Color from Poplar Wood.

This new coloring matter, says the *Moniteur de Fils et Tissus*, has received its name of ericine from *Erica vulgaris*, the botanical description of the common heath. It is prepared by heating with an alum solution the wood of (1st) the common heath; (2d) different kinds of poplar.

A liquor is obtained of a fine, clear yellow color, which becomes turbid on cooling, yielding a yellowish resin. The liquid separated from the resin by filtration oxidizes rapidly in contact with air and light, becoming at the end of a few days of a beautiful golden yellow, capable of competing with similar substances prepared in France by means of the weld (wau) of Avignon berries, or even with those manufactured in England.

The operation is conducted thus: The stems of the common heath, or the new branches and twigs of the poplar, cut, crushed, and pulverized, are boiled with alum solution in the following proportions: For 10 lb. wood, 1 lb. alum, 3 gallons water.

The whole is boiled for 20 to 30 minutes, then filtered. The filtrate becomes turbid on cooling, and deposits a greenish yellow resin abundantly. When the liquid is sufficiently free from the resin, it is filtered again and left for three or four days (sometimes five, according to the weather and season) exposed to the double influence of light and air. The liquor thus acquires the golden yellow color, and is fit to be worked either into extract or precipitated as a yellow lake. The extract is obtained in the usual way, by evaporating the mother liquor down either to a sirupy consistence or to the dry state.

The *ericine extract* has all the qualities belonging to the yellow extracts ordinarily found in commerce, but it surpasses most of them in brightness.

It is easily recognizable, not only by the peculiar orange appearance it possesses, but especially by chemical analysis, giving a peculiar brown coloration with alkalies, particularly with ammonia; besides which the alum it contains can be easily detected by the well known reactions for alumina. Here are a few of the results obtained with this new product:

Greens.—In connection with indigo, Prussian blue, greens can be obtained on wood, silk, cotton, etc.

Chamois and noisette shades with oak rind.

Green or bronze with most of the iron salts, especially sulphates.

Wood shades with nitrate of iron.

Orange in connection with red woods, as well as with cochineal, turmeric, etc.

Orange yellow with ericine extract alone. The goods are mordanted first with acetate of lead or manganate of potassium, tartar, or any other basic salt, or, better still, with muriate of tin; then it is dyed in a boiling bath with the necessary quantity of ericine.

Light yellow, on wool, cotton, etc., by simply dipping in the dye bath prepared with the extract.

Fast golden yellow obtained as follows: The liquor, oxidized by exposure to air, is treated with muriate of tin; this precipitates the lake, which has only to be collected on a filter and dried. This solid yellow can be employed in paper staining, in the manufacture of artificial flowers, calico printing; in one word, in all industries where a yellow in the solid is applicable. Finally it unites with Prussian blue or indigo to form greens, and with sandal wood to give oranges.

The Alum Industry of France.

The principal chemical factories for the production of alum, sulphate of alumina, and sulphate of iron in France, numbering about 10, are grouped around Laon, La Fere, and Noyon. Others are met with at Lyons, Paris, Fontainebleau, and Montpellier. They number 14 in all, and the value of the plant is estimated at 6,000,000 francs. They produce 180,000 tons of alum, sulphate of alumina, and sulphate of iron. These establishments use 70,000 tons of raw materials extracted from the soil or furnished by French industry, and supply to the railways and canals 40,000 tons to transport. They pay directly or indirectly in salaries a sum of 1,800,000 francs to 1,200 workpeople. These factories produce annually alum and sulphate of alumina exceeding the national wants by 4,000 tons, which finds its outlet in exports. It is not necessary to enlarge here on the various industrial uses of alum and sulphate of alumina: the paper manufacture, dyeing, and currying are largely dependent on it. The use of sulphate of iron is even more extensive: in dyeing, in the purifying of gas, the polishing of plate glass, the disinfection of fæcal matters, and agricultural operations it is extensively employed. Even the residues of the manufacture are utilized, in the state of the mother liquor, or the exhausted ashes, for purifying the sewage waters of towns, and a fertilizer for artificial grass lands. All these substances, therefore, are of real and indispensable utility as raw materials for a large number of industries. These facts are set forth in a memorial from the manufacturing chemists, complaining of the competition they meet with from Italy, and they oppose the renewal of the treaty of commerce with that country.

The importation of Italian alum has reached 2,000 tons, and the export of French alum dropped to 1,200 tons. In consequence five of the French chemical factories were closed last year. In 1876 a financial company became proprietors of the alum mines of Tolfa, formerly in the Papal States, which contain natural deposits of alum valued at 2,000,000 francs. These operations were aided by the treaty of commerce, which admitted alum at a duty of 5 per cent *ad valorem*, and by introducing large quantities of this Italian alum, they naturally sent down the price of the home production, so that it now fetches in Paris only about 18 francs the 100 kilos. The Italian company is enlarging its capital and operations, and pretends to be able to supply the universe with alum. Vessels loaded with 2,500 tons of the mineral have been sent to France to supply new factories being established at Rouen and Avignon. These 2,500 tons of raw materials represent more than 7,000 tons of pure alum, as the mineral is so rich that it yields 300 per cent. This composition, it is alleged, will close many more of the chemical factories, and also those making sulphate of iron, as this can only be made cheaply from the aluminous schists of Picardy. What the result of the Government Commission appointed to take this matter into consideration has been we do not know.

Pearl Inlaying.

Cast and sheet iron and *papier maché* are the materials upon which pearl is generally inlaid. If the article be of cast iron, it is well cleaned from the sand which usually adheres to the casting, and is blackened with a coat of varnish and lampblack. When this is thoroughly dried, a coat of japan or black varnish is spread evenly upon it. Before the varnish becomes too dry, pieces of pearl cut in the form of leaves, roses, or such flowers as the fancy of the artist may dictate, or the character of the article may require, are laid upon the varnish and pressed down with the finger, and they immediately adhere to the varnished surface. The work is then placed in a heated oven and kept there for several hours, or until the varnish is perfectly dried. It is then taken from the oven and another coat of varnish applied indiscriminately on the surface of the pearl and the previous coating, and again placed in the oven till dry. This process is repeated several times. The varnish is then scraped off the pearl with a knife, and the surface of pearl and the varnish around it are found to be quite even. The pearl is then polished with a piece of pumice stone and water, and the surface of the varnish is rubbed smooth with powdered pumice stone, moistened with water.

It is in this unfinished state that the pearl has the appearance of being inlaid, and from which it derives its name. Its final beauty and finish depend altogether on the skill of the artist under whose hands the shapeless and almost unmeaning pieces of pearl are made to assume the form of beautiful flowers, leaves, etc. The artist traces the stems and leaves of the flowers with a camel's hair pencil dipped in a size made of varnish and turpentine; upon this he lays gold leaf, which adheres where there is size, and the superfluous gold is carefully brushed off with a piece of silk. The flowers and leaves are then painted in colors, and when dry the picture and surface of the article are covered with a coat of refined white varnish.

The kinds of pearl used are three—mother-of-pearl, in the pearl oyster, or white pearl, as it is called by the artist, and it is known by its clear white surface; aurora shell, which can readily be told by its wrinkled appearance and its various prismatic colors, and is made from the shell of the genus of *Mollusca* known as the sear-ear or ear shell, and known to the conchologist as *Haliotis;* the green snail shell, which can be told by its glistening colors of light and dark green, or soft yellow and a bright and beautiful pink, blended together.

To manufacture the pearl ready for inlaying, the workman cuts the rough shells in pieces with saws, and then grinds the pieces upon both sides upon a common grindstone until they are of the requisite thinness. Out of these pieces the artist cuts the forms of leaves, flowers, etc., with a pair of common scissors preparatory to placing them in the varnished surface. The necessary forms may be cut from the thin pieces of pearl by means of a punch and dies, with power applied by the foot of the operator. When a number of pieces are required of the same size, the pieces may be fastened together with glue as one solid plate, and then the required form marked upon the outside one; then these being held in a vise, the form can be carefully sawed out with a fine saw. By placing the cemented pieces in warm water, the glue softens, and the shells are easily separated, and the glue washed off.

This art of inlaying is not confined to the representation of flowers alone; landscapes with houses, castles, trees, churches, and bridges are very easily made, and when represented as being seen by moonlight are very beautiful. The rising moon can be represented surrounded by clouds of gold and silver bronze; and when pieces of pearl are placed in certain positions to reflect their colors, the moonbeams are represented as glancing over the landscape in alternate light and shadow.

A varnished surface can be ornamented by transferring drawings or engravings to it, and the process is quite simple. A thin coat of copal varnish is spread upon the surface of the article, and when nearly dry the engraving is applied with its face downward and carefully pressed to exclude all air bubbles. When the varnish is sufficiently dry, the paper is thoroughly moistened with a sponge dipped in warm water, and the paper can be rubbed off, leaving all the lines of the print upon the varnished surface.—*Hardware.*

Nevada Names.

There is much in a name. A class of boys in geography will stumble dreadfully over a string of commonplace Smithtowns, Jonesvilles, Robinsonports, and so on. But we guarantee that not one in twenty would miss in reciting a lesson set down in genuine miners' terms, as, for example, this, from the geography of Nevada: "Buttermilk cañon is in the Paradise mountains, northwest from Eden, about ten miles from Gouge-Eye, on the road leading from Limburgs to Whoop-'Em-Up, via Bull Town, Lay-'Em-Out, and Hungry, and just over the mountains from Bung-Eye and Knock-'Em-Stiff."

Claude Etienne Minie.

M. Minie, the inventor of many improvements in firearms, died recently at Paris. He was born in Paris in 1805, and after serving several campaigns in Algeria was promoted to a captaincy of chasseurs. Subsequently he devoted himself to inventing improvements that would perfect the service of the infantry. Favored with the special protection of the Duke of Montpensier, he was able to secure the adoption of various of his improvements, which affected the shape and make of balls, cartridges, and gun barrels.

TYPE CASTING MACHINE.

Great advances have been made in the methods of casting type for printing purposes from the time of the wooden blocks and rude types of Laurentius, of Haarlem, to the improved hand moulds of Archibald Binny, of Philadelphia, at the beginning of the present century. By the latter as many as six thousand types per day were produced. The hand moulds were supplanted in 1845 by the complex and effective American type-casting machines, which have wrought an important revolution in the business.

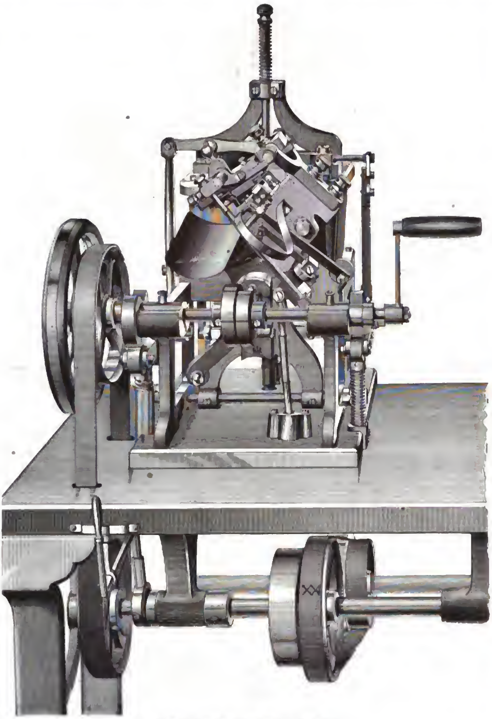
Our engraving represents a type-casting machine made by Messrs. MacKellar, Smiths & Jordan, of Philadelphia. The average production for this machine is about one hundred per minute for the ordinary sizes of printing type, being far beyond the amount of product of the earlier methods. The machines may be operated either by hand or power. The advantage in using power is that it enables one man to attend to two machines.

Type metal is an amalgam of lead, antimony, copper, and tin in such proportions as to produce a material hard but not brittle, ductile yet tough, flowing freely, yet hardening quickly. Each letter is first cut in reverse shape on the end of a short strip of steel, the greatest care being taken to insure accuracy of proportion and harmony of appearance to the letters of the entire alphabet. The least variation is inadmissible, as it would destroy the harmonious effect of the types when composed or formed into columns or pages. The steel strips when finished are termed punches; and after criticism and approval, each punch is placed in a stamping machine, and a deep impression made of it in one side of an oblong piece of copper near its end. These pieces of copper are called matrices. They are dressed and fitted up with delicate skill, so that the types cast from them shall be of uniform height and accurate range. They are then ready for use in the casting machine.

The machine casts but one type at each revolution. It consists of a furnace, on the top of which is a small reservoir of metal kept in a fluid state. In this reservoir is a pump, the plunger of which operates in a cylinder in the bottom, and projects at each stroke a small quantity of the molten metal out from a small hole in a spout or nipple in the front face. The mould in which the stem or body of the type is formed is of steel and is movable, being set in place in front of the reservoir, and worked by the action of the same machinery which operates the pump. The copper matrix, containing any special letter stamped into it with the punch, rests with its face against the bottom opening of the mould, being held in position by a curved steel spring shown in the engraving. The method of operation is as follows:

The initial movement of the machine brings the upper opening in the mould opposite to the matrix exactly against the hole in the nipple. A simultaneous action of the pump projects a stream of the liquid metal into the mould with considerable force, at the same time stopping the opening in the nipple by a small plug from behind to prevent the further escape of metal. The next movement draws the mould away from the nipple and opens it, throwing back the matrix, extricating the type, and dropping it by a slide into a box below. This operation is repeated over and over again as rapidly as the crank or wheel of the machine is turned, and a type is cast each time. On the rapidity of the motion depends the quantity produced. Such is the modern type casting machine—turning out one hundred types per minute, or sixty thousand per working-day of ten hours, every one of which is a mite contributed to the spreading of knowledge over the world for good or for evil.

The type as thus formed is passed to boys, who break off the jets or waste ends; then to the dressing-room, where the rough edges are rubbed off on the faces of large circular stones, and finally, they are set up in lines, slipped into a long stick, screwed tight, and the bottom of the type is neatly grooved by a planing-tool. The letters are afterward closely inspected with a magnifying glass, and all imperfect ones rejected.



STEAM TYPE CASTING MACHINE.

MISCELLANEOUS INVENTIONS.

Mr. William Gardner, of New York city, has patented an improved apparatus for keeping lager beer, ale, porter, cider, etc., fresh and lively from the time it is tapped until the contents of the cask are exhausted. The invention consists of a combination of devices which cannot be clearly described without engravings.

An improved fire lighter, patented by Mr. Samuel M. Craig, of Austin, Tex., consists in the arrangement of a clamp holding a match and a slide provided with a roughened surface by means of sandpaper or some other suitable material, so that when the rough surface is drawn across the head of the match, the match is ignited and will light the kindling materials.

An improvement in tellurians has been patented by Mr. Gideon McBride, of Dover Hill, Ind. The object of this invention is to furnish for the use of schools an improved tellurian of simple construction, by which the elliptical orbit of the earth around the sun and the orbit of the moon around the earth, together with all the phenomena resulting from the relation of sun, earth, and moon together, may be fully and lucidly illustrated, embracing among others the succession of day and night, the changes of the seasons, the changes of the moon, solar and lunar eclipses, the entrance and progress of the sun into and through each of the twelve signs of the zodiac, the entrance and progress of the earth into and through each of the twelve months of the year, etc.

Mr. Fortonato C. Zanetti, of Bryan, Texas, has patented improvements in the construction and arrangement of cabinets for containing sewing, writing, and shaving materials and various other articles of domestic use in frequent demand.

Mr. John Boyd, of La Grange, Ind., has patented an adjustable hay rack for wagons or sleds, that may be lengthened or shortened at will. The sections can be easily separated from each other and handled by one person. It may be lengthened or extended from twelve to twenty feet or more to fit any length of wagon or sled within reasonable limits.

Mr John G. Barrington, of North Sidney, Nova Scotia, has patented an improved oil cup or lubricator for those parts of machinery that have a reciprocating upward and downward movement; it consists of a globular cup provided with an interior vertical valve and a screw cap carrying a tube provided with a regulating spring and rod. A concave plate of sheet metal is attached to the top of the tube. As the machinery to which it is attached moves up and down the resistance of the air to the movement of the plate operates the device.

An improved attachment for cultivators, which will do away with stay rods or chains, will give a direct draught, and will prevent any down draught upon the horses' necks, has been patented by Mr. Jonas Dierdorff, of Goshen, Ind.

Mr. Moritz Leiner, of New York city, has patented an improved combined slate cleaner and pencil holder, which consists in a vessel or cup provided with a sponge upon its lower part, and having a stopple provided with sponges at one or both ends, and the cord provided with the loop and the hook.

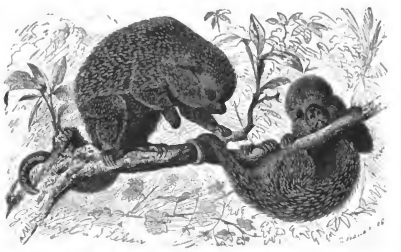
An improved egg carrier, patented by Mr. George W. Peck, of Omaha, Neb., is designed especially for carrying eggs, but it may be used for other purposes. It consists in a box having a cover made with cleats or flanges to rest upon the edge of the body. The body is made with a cross partition projecting above its edge so as to pass in between the side cleats of the cover and rest against the cover. The box is provided with a novel and efficient fastener.

THE BRAZILIAN PORCUPINE.

In Southern America the porcupines find a representative in the coendoo, an animal which is not only remarkable for its array of quills, but also for the prehensile power of its long tail.

As might be presumed, from the prehensile tail and the peculiarly armed claws, the coendoo is of arboreal habits, finding its food among the lofty branches of trees. On the level ground it is slow and awkward, but among the more congenial boughs it climbs with great ease, drawing itself from branch to branch by means of its hooked claws; but seldom using its tail, except as an aid in descent. The food of this animal consists of leaves, flowers, fruit, bark, and the soft woody substance of young and tender branches, which it slices easily with its chisel-edged incisor teeth. During the summer months the coendoo becomes extremely fat, and its flesh is then in great request, being both delicate in flavor and tender in character. The young of this animal are born in the month of September or October, and are very few in number.

The total length of the coendoo is about three feet six inches, of which the tail occupies one foot six inches. Its nose is thick and blunt, like that of the common porcupine, and the face is furnished with very long whisker hairs of a deep black. The numerous spines which cover the body are parti-colored, being black in the center and white at each extremity. Their length is rather more than two inches on the back, an inch and a half on the fore legs, and not quite an inch on the hinder limbs. A number of short quills are also set upon the basal half of the tail, the remainder of that organ being furnished with scales, and tapering to its extremity. The color of the scales is black. The entire under surface of the tail is covered with similar scales, among which are interspersed a number of bright chestnut hairs. The abdomen, breast, and inner face of the limbs are clothed with dense, brown, coarse hairs. It is a nocturnal, sleeping by day, and feeding by night.



COENDOO, OR BRAZILIAN PORCUPINE.—*Cercolabes prehensilis.*

SNAKE EATING SNAKE.

We do not know that either of the snakes shown in the engraving is a snake-eating snake, but it is certain that a portion of one snake, by accident or otherwise, has passed between the jaws and through a considerable portion of its body. The double specimen from which our engraving is made, and which we now have before us, was captured in a hay field near the village of Collinsby, Canada, by Mr. John Filmer, a well known engraver of this city.

It is Mr. Filmer's opinion that while thrusting the fork into the hay to get a lift he must have struck the belly of the larger snake, making the opening through which the smaller one was partly liberated. Both snakes were alive. The larger one is familiarly known as the garter snake; the smaller one as the common brown snake.

SINGULAR RESULT OF A SNAKE ENCOUNTER.

Sea Snake Caught in Submarine Telegraph Wire.

Mr. Moginie has called upon me, says Frank Buckland, the celebrated naturalist, in *Land and Water*, with a lovely specimen of a sea snake which he wanted properly mounted in a bottle for the board-room of the Eastern Extension Telegraph Company. One of the cables belonging to this company was being raised from the bottom of the sea, I believe in the Indian Ocean. When the cable came to the surface the snake in question was found coiled tightly round the telegraph cable. Luckily it was killed before it could do any mischief, as these sea-snakes are excessively poisonous. In the College of Surgeons there is a sea snake which crawled up the anchor chain of a man-of-war when she was moored in the mouth of the Ganges. The midshipman of the watch saw something moving along the chain, and without thinking, went to pick it up. The venomous brute immediately turned upon him and bit him. The poor young midshipman did not live many hours after the accident. Mr. Moginie's snake is about a yard long, and the general color of it is white, and it is most beautifully marked on the back with black, or rather dark chocolate, patterns.

The tail is, as in all sea snakes, quite flattened, like the end of an oar. This, of course, gives the animal great power of swimming. My friend, Dr. Day, luckily came in just as I was consulting Sir Joseph Fayrer's magnificent illustrated work on the "Venomous Snakes of the Indian Peninsula," and I am now enabled to give the following account of it by Dr. Day:

"The example of sea snake (*Pelamis bicolor*) which you showed me as having been killed by a deep sea telegraph wire in the Indian Ocean is a species having a very wide geographical range. I have taken an example in Scinde, another in Orissa, while it is reported to extend throughout the subtropical and tropical portions of the Indian Ocean. I have only met with a few examples, and do not look upon it as nearly so common as the blue banded *enhydrina*. All these seasnakes, I need scarcely observe, are exceedingly venomous.

"This instance recalls to my mind a circumstance which," continues Dr. Day, "occurred off the coast of Beloochistan, near the Persian Gulf, in 1871, when the telegraph cable was ruptured. A few days subsequently the dead body of a whale was discovered on the sea beach, and I think the end of the cable was found wound round the animal's tail, just in front of the tail fin. It appeared to me that the accident must have occurred somewhat in the following manner, premising that (as all know) the tail fin of a whale is placed transversely to the body, and not as in a fish. If the telegraph wire passed from one rock to another, or from an elevated spot to the bottom of the sea, it would not be difficult to imagine that a whale swimming past might very easily become entangled. Should its transverse tail have hitched over the wire the animal would become frantic, and rolling itself round and round, it might burst the wire in two, but still be held fast, due to telegraph wire encircling its tail just below the origin of the fin."

Intellect in Brutes.

The Duke of Argyll, in his "Reign of Law," was, I think, the first who promulgated the dictum that man is the only tool-making animal. As far as I can ascertain, this assertion is admitted by developmentists, yet it is undoubtedly true that the Indian elephant makes two *implements*, or forms and alters certain things so as to adapt them specially to fulfill definite purposes, for which, unaltered, they would not be suitable.

One evening soon after my arrival in Eastern Asam, and while the five elephants were as usual being fed opposite the Bungalow, I observed a young and lately caught one step up to a bamboo stake fence and quietly pull one of the stakes up. Placing it under foot, it broke a piece off with the trunk, and after lifting it to its mouth, threw it away. It repeated this twice or thrice, and then drew another stake and began again. Seeing that the bamboo was old and dry, I asked the reason of this, and was told to wait and see what it would do. At last it seemed to get a piece that suited, and holding it in the trunk firmly, and stepping the left fore-leg well forward, passed the piece of bamboo under the armpit, so to speak, and began to scratch with some force. My surprise reached its climax when I saw a large elephant leech fall on the ground, quite six inches long and thick as one's finger, and which, from its position, could not easily be detached without this scraper, or scratch, which was deliberately made by the elephant. I subsequently found that it was a common occurrence. Leech scrapers are used by every elephant daily. On another occasion, when traveling at a time of year when the large flies are so tormenting to an elephant, I noticed that the one I rode had no fan or wisp to beat them off with. The mahout, at my order, slackened pace and allowed her to go to the side of the road, where for some moments she moved along rummaging the smaller jungle on the bank; at last she came to a cluster of young shoots well branched, and after feeling among them, and selecting one, raised her trunk and neatly stripped down the stem, taking off all the *lower* branches and leaving a fine bunch on top. She deliberately cleaned it down several times, and then laying hold at the lower end broke off a beautiful fan or switch about five feet long, handle included. With this she kept the flies at bay as we went along, flapping them off on each side every now and then. Say what we may, these are both really *bona fide* implements, each intelligently made for a definite purpose.—*S. E. Peal, in Nature.*

Mating of Queen Bees.

At the late Bee-keepers' Convention, Chicago, Professor J. Hasbrouck, of Bound Brook, N.J., after relating many failures, went on to state the plan which he had finally found successful. It was as follows:

I took an empty sugar barrel, clean and tight, with a cover fitting tightly over the upper hoop, and into this cover I cut a round hole about four inches across in the center, and fastened a piece of glass against it on the under side. I now waited until I had the queen again in the trap, which happened about 2 o'clock. I put three drones with her, and threw them all into the barrel, standing in the bright sunlight, and quickly closed the lid. They all immediately flew to the glass, and before I had got ready to look at them fairly, the queen had mated with one of the drones. I took the barrel into a room and caught the queen and returned her to the nucleus. I had two other young queens which I expected would soon be out, and I had traps then set to catch them; but in my anxiety to see if the thing could be done again, I could not wait for them to come out, so I went to the hive and caught one of these queens with a queen cage and put her into the barrel with drones. She mated about as quickly

as the other. I next tried the third, and she likewise mated; not one of the three being in the barrel five minutes.

This was my last queen for the season. But I have done. I can hardly expect that every queen will mate as soon as these did; but the arrangement, simple as it is, accomplishes everything that seems to be necessary—namely, it induces the bees to fly without the loss of any time, to fly in close proximity to each other, and to keep constantly turning so as to notice immediately a mate when near; and so, I believe that queens can be put through the process with sufficient rapidity to make the method satisfactorily practical. With the right kind of a fertilizing cage, it does not appear to be essential that the queen should be caught on her way out to mate. I think she should be confined to the nucleus, till she is certainly old enough to mate, and then picked out and put into a fertilizing cage; but neither she nor the drones should be taken hold of with the hands nor squeezed or touched with anything that would daub them in the least.

Observing this caution, I think that any bee-keeper who will try, can in this way have all his queens fertilized in confinement; while the trouble required is as nothing compared to the loss he can prevent, and the control he can exercise over the purity and improvement of his stock.

J. Boggs, of Havana, Ill., gave his experience in the matter. He had covered over a hive in which were some queen cells with mosquito netting. When one of the queens hatched out and flew against the netting she had mated with a drone.

Mr. Clemet, of Iowa, had tried an experiment almost similar, and with equally good results.

Mr. King, of New York, stated that he had a correspondent in North Carolina who stated that he had been successful in fertilizing artificially.

An Oil-Producing Insect.

We extract from *La Emulacion*, published at Merida, Yucatan, the following notes on an interesting insect to which we briefly referred not long ago. This insect, which has considerable economic use in Central America, belongs to the same genus as the cochineal, and is called by the native name of "ni-in." Being unknown to science, the author names it *Coccus adipofera*. The females are of a coral-red, and are covered with a fine whitish powder. They live on trees belonging to the genus *Spondias*, and known as "hog plums," their food consisting of the sap. They adhere to the trees by means of their beaks, remaining motionless, and existing in such large numbers that they frequently cover every portion of the plant.

There is extracted from these females 26 to 28 per cent of their weight of a bright yellow fat having an odor *sui generis*, and which when recently melted is homogeneous, but in a short time becomes granular and of a lighter color. It is the most quickly drying oleaginous substance known, since it becomes immediately covered over with a pellicle full of wrinkles and folds; and, if this pellicle be dipped into the grease to exclude its surface from contact with the air, the whole mass shortly becomes transformed into an infusible and insoluble resinous substance. Applied to paper or any other surface, this grease dries in six or seven hours so as to form a smooth lustrous surface, and almost odorless. Mixed with copal, or any other resin, and turpentine, it forms a golden-yellow drying varnish. Its melting point is 36°. Heated to a temperature of 200° to 210° until it becomes glutinous, it changes on cooling into a bland elastic mass (caoutchouc of ni-in) which is almost insoluble in spirit of turpentine, but soluble in bisulphide of carbon. In 95 per cent alcohol it is but slightly soluble. The various properties of this fatty matter, and its behavior with acids and alkalies, prove that its chemical composition differs from that of all other oils known. Like all drying oils, it forms by the action of heat a glutinous substance; but, while heat is indispensable to make such oils more siccative, the ni-in grease loses a portion of this property through heating. The elastic substance of oils is soluble in ether, and especially in turpentine, but that of ni-in is nearly insoluble in these materials.

In some localities in Central America this oil is largely employed for painting wooden utensils, such as ladles, etc., a mass being made with color, chalk, and the grease, and applied precisely as in ordinary oil painting. It has been observed that articles painted with it may be preserved for a long time. Guitar manufacturers also use the grease in varnishing their instruments. As yet it has received no application in pharmacy. It is probable that the ancient race which formerly peopled Central America used this grease in painting their buildings, and it is for this reason that, after a lapse of several centuries, the decorations are still to be seen in that perfect state of preservation which caused the admiration of Mr. Stevens when he visited these ruins in 1842. The journal above quoted trusts that attention will be paid to the propagation, instead of the careless destruction, of the insect, to the end that a native industry may spring up which will give the country a supply of oil that shall prove a substitute for linseed oil, which is now imported from foreign lands, and which, it adds, is often adulterated with fish oil.

Skatol.

In his researches on the volatile substances contained in human fæces, Brieger isolated a series of bodies belonging, some to the fatty and others to the aromatic class. The principal aromatic product of the decomposition of albumen in the intestinal canal, is a substance resembling indol, to which he has assigned the name skatol. It crystallizes in brilliant white plates and possesses an intense fecal odor. It fuses at 93·5°, and is difficultly soluble in water. Warmed with dilute hydrochloric or nitric acid, it gives a violet color. Analysis gives it the formula C_9H_9N, its vapor density being 65·2. Blood albumen, digested with pancreas and water at 36° C. for six to ten days, yields skatol on distillation. Two and a half kilogrammes albumen gave one gramme of skatol.—*Ber. Berl. Chem. Ges.*

How English Carpets were Driven out of American Markets.

Commenting on the influence of the power looms invented by Erastus B. Bigelow, whose recent death was noticed in a late number of this paper, a contemporary says:

Prior to Mr. Bigelow's invention America was making ingrain carpets, but the demand was limited and the popular impression favored English goods. The adoption of his loom by the Lowell Company at once sent the products of that now famous corporation to the front, and for a while the good housewives of the country would have no other. From that time the trade has steadily increased until to-day, with the exception of a few yards of such goods as those designed by Mr. Morris, no such thing as a foreign ingrain is ever seen in this market, the total importation of their goods last year being $957, while the city of Philadelphia alone last year made over twenty million yards, mostly ingrains, and the Lowell and Hartford Companies, E. S. Higgins, Stephen Sanford, D. M. Reed and others added several millions more. The enormous extent of American consumption can be seen from the fact that the total production of Great Britain in all kinds of carpets was less than fourteen million yards.

In other grades of carpets the advance has been no less astonishing. Next in popularity and extent of consumption to the ingrain come the tapestry Brussels. A glance at the figures of the Custom-House will probably surprise the uninitiated reader. Beginning with the time when importations were at their highest, the following are the numbers of square yards of tapestry carpets landed in this country:

1871-2	2,750,000	1875-6	546,000
1872-3	2,100,000	1876-7	270,000
1873-4	2,040,000	1877-8	94,000
1874-5	1,454,000	1878-9	23,000

On the other hand all the American manufactories were running on these goods in 1872 only 143 looms. There are now in operation, and in many cases running over-time, 649 looms, producing over 8,500,000 yards of (three-quarters wide) carpet. There are now going up or contracted for by various manufacturers 200 more looms, which will bring the production up to 13,000,000 yards.

In the more expensive body Brussels the importations have decreased in nearly the same ratio, as follows:

1871-2	1,168,000	1875-6	286,000
1872-3	998,000	1876-7	131,000
1873-4	698,000	1877-8	91,000
1874-5	410,000	1878-9	53,000

It is noticeable, moreover, that our machinery has improved with equal rapidity, until to-day the Murkland or Duckworth looms are almost as much better than the old Bigelow looms as these were better than their predecessors.

An Englishman's View of Protection.

In a long letter to the Sheffield *Daily Telegraph*, discussing the causes of industrial depression in England, Mr. Edward Sullivan, of Sheffield, uses some plain language with regard to "the sophisms, the paradoxes, the theories of Free Trade." He says: "In America, France, Belgium, Germany, Switzerland, Holland, in fact, wherever the common sense of mankind is allowed to assert itself, the first and great commandment, the 'whole law and the prophets' of political economy is allowed to be this: 'That national prosperity depends on general employment.'

"The skill or industry of the workman in his trade is his capital, 'the capital of labor;' in an industrial community the capital of labor is the chief productive capital of the country, but without general employment it is valueless. It is general employment that turns over this capital, and makes it increase and multiply.

"The 'capital of labor' cannot afford to remain long idle. If employment is denied in one place it speedily emigrates to another more congenial.

"This is the first lesson of political economy as read by the light of universal suffrage in France and America, and so it would be the reading in England, too, if we had universal suffrage."

Further on he says: "America, France, and Belgium have never swerved in one single instance from their policy of protecting the employment of the people; and what is the result?—that the capital of labor has been steadily turning over, accumulating and multiplying, and enriching all classes of the community. In America, especially, the effect of protecting the employment of the people has been little short of marvelous. The best workmen of England have flocked to her; industries that ten years ago had no existence, have sprung into vigorous life; she has multiplied her make of Bessemer steel eighteen times in ten years; she has seven hundred iron works in full operation; she now supplies herself in almost every manufactured article she requires; and neither war nor rebellion, nor debt, nor soft money, nor hard money, has been able to cause more than a temporary derangement of her prosperity.

"This is the country that Mr. Vivian tells us, in his interesting notes on America, 'has the curse of protection upon it,' 'and,' adds he, with a genuine burst of free trade fanaticism, 'where man interposes his short-sighted laws, the best provision of Providence is shackled and blighted.' Are we to understand that America is shackled and blighted, or merely that free trade has a Divine origin?

"We see what America is. What she would have been if free trade had been her destiny instead of protection we can easily realize. There would be no iron works, no cotton works, no glass works, no paper factories, no teeming hives of industries; every manufactured article would be imported from Europe. Her iron and coal mines would be still undeveloped; she would remain a purely agricultural country, like Russia, and her progress and civilization would be indefinitely postponed."

David Haviland.

David Haviland, of New York, founder of the firm of Haviland & Co., porcelain manufacturers, of Limoges, France, died December 12, in his sixty-fifth year. Mr. Haviland was born in Westchester County, N. Y., in 1814. In 1836 he was engaged in the importation of English earthenware, but owing to the superiority of the French ware he visited France in 1840.

Resolving to discover if possible the secret of the production of French porcelain, Mr. Haviland went to Paris and afterward to Forey, but finding himself unable successfully to prosecute his work in those places, he finally established himself in 1842 at Limoges, the only place where good kaolin is to be found in France. Here he built his manufactory. The industry of porcelain had then hardly obtained a footing, and Mr. Haviland found that he was obliged to manufacture everything connected with the work. However, despite the many difficulties to be surmounted, the undertaking did not prove too formidable for his energy and perseverance. He began to make shapes, and employed four professors to educate 200 pupils, as no good painters were then to be found in the place. At first he did not attempt to make any porcelain, but he soon was able to undertake its manufacture. With the increase and development of the business many improvements were made, so that a great part of the modern process of manufacturing and decorating this kind of ware originated with his firm. The faience called the Limoges would more properly be called the Haviland, since it is all produced at their Auteuil factory, it being impossible, it is said, to secure at any distance from Paris artists of sufficient reputation to paint this ware.

The Limoges factory is in the center of the city, and covers three acres of ground. There are nine double kilns for porcelains, twenty-one muffles for fixing the decorations, and about 1,200 persons are continually employed.

The Healing Power of the Imagination.

The records of medical practice are full of illustrations of the influence of the imagination, for good or evil, over the functions of the body; and philosophy finds in them a key to the wonderful persistence of many popular superstitions. The firm belief that any disastrous physiological result, even death itself, will surely follow a given act or occurrence, is very apt to bring about the dreaded calamity; and every repetition of the seeming sequence of cause and effect, tends to confirm and strengthen the mischievous belief. As a means of counteracting this tendency of perverted imagination, charms for averting evil often play a really beneficial part. The protection is as imaginary as the dreaded evil; but, assuming a belief in the fictitious danger—a belief strongly tending to make the danger real, the charm substitutes a more hopeful belief, and the danger ceases.

A curious illustration of this action of the mind is reported from San Francisco, in connection with a case of transfusion of blood. An aged negro, at the point of death, was saved by this operation, the blood—about eight ounces—being taken from his wife's arm. The man recovered, but the woman went into a curious decline, against which tonics and nourishing food were of no avail. At last the patient confided to the doctor the secret of her ailment, which kept her from resting day or night. "I tell you, doctor," she said whisperingly, "its that blood of mine the old man is carrying about inside of him; and, doctor, when that old man comes back, I want you to give me my blood back." The doctor, seeing that the woman would not be appeased unless he complied with her request, promised to return the next day, first informing her of the dangers of the operation, and that it was resorted to only in the most urgent cases. She would hear of no explanations, but demanded that the operation be gone through with. It was accordingly done the next day, the doctor taking from the man about half an ounce of blood and transfusing it into the woman's veins. After the operation the woman brightened up perceptibly, saying, "I'll be all right now, doctor." And that the operation did prove a success was fully demonstrated by the sick woman, who began work a few hours afterward, declaring that the "doctor was a wonderful man, and now that she's got her own blood back again she was all right."

The Electric Light at Sea.

The pioneer in the use of the electric light in passenger steamers, the Inman steamship City of Berlin, arrived at this port, October 14. Six electric lamps were employed, four in the main saloon and two in the steerage, each of 400 candle power. The passengers expressed themselves as highly delighted with the new method of illumination.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 733 Broadway, N. Y.

Wanted—Situation as Analytical Chemist or Assayer. Address H. F. Starr, 90 Mt. Pleasant Ave., Newark, N. J.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 421.

The Steam Pipes, Boilers, etc., of the Tradesman's National Bank, Broadway National Bank, and First National Bank are protected with H. W. Johns' Asbestos Boiler Coverings. H. W. Johns Manufacturing Company, No. 87 Maiden Lane, New York, sole manufacturers of genuine Asbestos Liquid Paints, Roofing, etc.

Wanted—A Nut Machine and a Bolt Header. Address, stating particulars and prices, E. & S., Box 773 New York city.

Twelfth Year. Prof. P. H. Vander Weyde, Editor. Send 10 cents for a specimen copy of the Manufacturer and Builder, the best and cheapest mechanical journal published. Address H. N. Black, Publisher, Box 4577, New York city.

A New Health Almanac and Annual of Phrenology for 1880, will be sent to every reader of the SCIENTIFIC AMERICAN who will send three 3c. stamps to the publishers, S. R. Wells & Co., 737 Broadway, New York.

Attention is directed to the new and readable prospectus of the New York Ledger in our advertising columns.

Wanted—Watchman's Time Detector. Penfield Block Works, Lockport, N. Y.

Band Saw, Jig Saw, and other Wood-working Machines. F. Pryibil, 467 W. 40th St., New York.

Jewelry Boxes with Safety Locking Device. Security against sneak thieves and dishonest domestics. Just the thing for a Holiday Present. See adv. of Frothingham & Emory, Safe M'f'rs, outside page.

Brick Presses for Fire and Red Brick. 300 S. Fifth St., Phila., Pa. S. P. Miller & Son.

Combined Step Ladder, Ironing Table, Clothes Frame. Good thing sure. See adv. last week.

Crucible Steel Castings that weld and work like bar steel. All articles difficult to forge. Special facilities and skill in plow castings and agricultural work. Also agricultural wrought steels and shapes. Write to Reed, McKee & Co., limited, Pittsburg, Pa.

Fire on the Hearth.—Open grate and warm air furnace combined. Circulars by O. S. & V. Co., 78 Beekman St., N. Y.

Telephones repaired; parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Hub Mortisers; latest improved. Witherby, Rugg & Richardson, Worcester, Mass.

Machine Drawing Copies, 10 cents each. Descriptive list and catalogue of scientific books sent free by mail on application. E. & F. N. Spon, 446 Broome St., N. Y.

The Friction Clutch Capstan will start calender rolls for rubber, brass, or paper without shock; stop quick, and will save machinery from breaking. D. Frisbie & Co., New Haven, Conn.

For Sale.—One Horizontal Steam Engine, 20'' x 48''; one 18'' x 42''; one 16'' x 30''. Atlantic Steam Engine Works, Brooklyn, N. Y.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Park Benjamin's Expert Office, Box 1009, N. Y. Recipes and information on all industrial processes.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 408.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Eclipse Portable Engine. See illustrated adv., p. 380.

For best Fixtures to run Sewing Machines where power is used, address Jos. A. Sawyer & Son., Worcester, Mass.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery. Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. page 405.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 405.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Light and Fine Machinery contracted for. Foot Lathe Catalogue for stamp. Chase & Woodman, Newark, N. J.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 9 cents per pound. Fully warranted.

Repairs to Corliss Engines a specialty. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Oak Tanned Leather Belting, Rubber Belting, Cotton Belting, Polishing Belts. Greene, Tweed & Co., N. York.

Walrus Leather, Solid Walrus Wheels, Wood Wheels covered with walrus leather for polishing. Greene, Tweed & Co., N. Y.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$400 Vertical Engine, 30 H. P. See page 350.

No gum! No grit! No acid! Anti-Corrosive Cylinder Oil is the best in the world, and the first and only oil that perfectly lubricates a railroad locomotive cylinder, doing it with half the quantity required of best lard or tallow, giving increased power and less wear to machinery, with entire freedom from gum, stain, or corrosion of any sort, and it is equally superior for all steam cylinders or heavy work where body or cooling qualities are indispensable. A fair trial insures its continued use. Address E. H. Kellogg, sole manufacturer, 17 Cedar St., New York.

Emery Wheels for various purposes, and Machines at reduced prices. Lehigh Valley Emery Wheel Company, Weissport, Pa.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 382.

Patent Steam Cranes. See illus. adv., page 254.

National Steam Pump. Simple, reliable, durable. Send for catalogue. W. R. Kelly, New Brunswick, N. J.

Deoxidized Bronze. Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423 Pottsville, Pa. See p. 318.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

Catechism of the Locomotive. 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

For Machine Knives and Parallel Vises, see advertisement, p. 349. Taylor, Stiles & Co., Riegelsville, N. J.

Steam Engines, Automatic and Slide Valve; also Boilers. Woodbury, Booth & Pryor, Rochester, N. Y. See illustrated advertisement, page 413.

NEW BOOKS AND PUBLICATIONS.

MATHEMATICAL TABLES. First Series. By Professor James Mills Peirce. Boston: Ginn & Heath.

Contains tables, chiefly to four figures, as follows: Logarithms; logarithms of circular functions; logarithms of sums and differences; inverse circular functions; logarithms of hyperbolic functions; natural sines and cosines, natural tangents and cotangents, natural secants and cosecants, table of proportional parts. In addition are ten sections devoted to instruction with regard to tables in general and the particular uses of the tables given.

KEY TO THE UNIVERSE, OR A NEW THEORY OF ITS MECHANISM, WITH MATHEMATICAL DEMONSTRATIONS AND TABLES. By Orson Pratt, Sen. Published by the author, Historian's Office, Salt Lake City, Utah.

Mr. Pratt's theory rests upon a double hypothesis involving: I. A continuous orbital propulsion, arising from the velocity of gravity and its consequent aberrations; II. A resisting ethereal medium of variable density. The object of the theory is to "extend the universality" of the law of universal gravitation. The author asserts and essays to demonstrate mathematically the existence of an ocean of rotating currents, set in motion by the rotation of the sun, and extending outward millions of millions of miles; so that all bodies entering the sun's dominions must partake not only of his controlling power of gravitation, but also of the great controlling power of rotation, which in connection with ethereal resistance must determine their orbital paths, prescribe their annual periods, and point out their axial rotations.

CATALOGUE OF SCIENTIFIC SERIALS. By Samuel H. Scudder. Cambridge: Library of Harvard University.

This excellent catalogue covers the entire range of scientific serials of all countries, including the transactions of learned societies in the natural, physical, and mathematical sciences, from 1633 to 1876. There are added an index of towns (places of publication); an index of titles; and one of special subjects, such as anatomy, astronomy, botany, chemistry, etc. Thus in the index of towns under New York, the searcher is referred to the pages in the national division, United States, in which the scientific serials of New York are entered. Here, for example, we find the SCIENTIFIC AMERICAN described, mentioning its scope, time of beginning, number of volumes, etc., besides some dozen or more other scientific periodicals which have started and died since this paper began to be published. For students engaged in special investigations or in looking up the history of any science the catalogue must be extremely useful. As the library of Harvard has no funds for the publication of such volumes it is to be hoped that this and similar ventures which it has in hand may somehow be made to pay their cost.

ELEMENTS OF DIFFERENTIAL CALCULUS, WITH EXAMPLES AND APPLICATIONS. By W. E. Byerly, Ph.D. Boston: Ginn & Heath. Price $2.50.

A text book embodying the results of Professor Byerly's experience in teaching the calculus at Cornell and Harvard. It is practical throughout, and apparently well suited for the use intended. Its professed peculiarities are the rigorous use of the doctrine of limits as a foundation of the subject, and as preliminary to the adoption of the infinitesimal notation and nomenclature; the early introduction of simple formulas and methods for integrating, and a rather elaborate treatment of the use of infinitesimals in pure geometry.

INSECT LIVES; OR, BORN IN PRISON. By Julia P. Ballard. Cincinnati: Robert Clarke & Co.

Designed to awaken in children an interest in the lives of our more common moths and butterflies, and to show them how to study such lives scientifically and entertainingly. The work is prettily done and admirably calculated to effect the author's purpose.

FOOT PRINTS OF VANISHED RACES IN THE MISSISSIPPI VALLEY. By A. J. Conant. St. Louis: Chancy R. Barnes.

Gives an account of some of the monuments and relics of prehistoric races scattered over the surface of the Mississippi Valley, with suggestions as to their origin and uses. Mr. Conant is an enthusiastic student of American archæology in the field as well as in the reports of other observers, and writes with unusual fullness of knowledge. His investigations lead him to the belief that the original inhabitants of America were Autochthons. The civilized tribes which the Spaniards found in Mexico were all branches of the great Nahua family, whose origin has not been clearly traced. In the advent of the Toltec domination the first gleams of ancient American history begin to be visible. The original seat of the Nahua race, he is inclined to believe, must be sought for in the Mississippi Valley. The Indians are a later race, evidently of Asiatic origin.

INDUSTRIAL HISTORY OF THE UNITED STATES. By Albert S. Bolles. Norwich, Conn.: Henry Bill Publishing Company. 8vo, pp. 936.

This work occupies, and on the whole commendably, a decided gap in popular literature. Its most obvious fault is the lack of a good index, indeed an index of any sort; a lack which seriously diminishes its usableness and usefulness. Each great department of productive industry is taken up in a special book, separate chapters being given to each important subdivision. Here under agriculture and horticulture there is a chapter of general history followed by chapters on agricultural implements, cotton, wheat, corn, sugar, tobacco, hay, minor crops, neat cattle, dairy products, the horse, sheep, swine, horticulture, nurseries, and fruit raising. In like manner the historical development of each of the various lines of manufacture is sketched with considerable fullness of detail, considering the vast breadth of the field covered. Shipping and railroads; mines, mining and oil; banking, insurance, and commerce; trades unions and the eight hour movement; and the industries of Canada are severally honored with a separate book. The work is copiously illustrated, the selection of the engravings being determined apparently by their availability oftener than by their superior merit. The author has taken no little pains to bring his history well down to the date of publication, and his work is one that should go into every school and family library. If it could take the place of some of the political and military histories used as text books in our higher schools the change would be a beneficial one to the country.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

---

(1) H. P. G. asks (1) how to make a cheap and serviceable emery wheel. A. Turn wheels from well seasoned pine, of the form desired; place emery upon an iron plate heated to 200° to 212°; coat the wheels with glue prepared as for uniting wood, and roll the wheels in the warm emery. After the glue dries, the surplus emery is brushed off and another coating of glue is applied and the wheels are again rolled in the warm emery. The wheels should be allowed to become thoroughly dry before use. 2. How can I make emery sticks? A. Prepare sticks of such forms as you may require, and coat them as directed for emery wheels, or attach to them emery paper by means of glue or paste.

(2) F. J. W. asks: 1. Why do we hear sound farthest just before a storm, when the atmosphere is lightest? A. Two reasons are given for this phenomenon: one is, that the air being moist, has more than its normal conducting power; the other is, that the low lying strata of clouds confine the sounds to the earth. 2. If, as we are taught by philosophy and observation, cold contracts and heat expands the atmosphere, why does rarefied air prove to be so cold as to preserve snow and ice at a few thousand feet above sea level? A. The rarefied air in which the snow and ice exist is not rarefied by heat but by decreased pressure. Rarefaction of air diminishes its heat-absorbing power. Another cause which influences the temperature at great heights is its removal from the ground which heats it by contact. And still another reason is that the air is drier, and therefore very diathermanous.

(3) A. H. asks how to make a cement for sharpening knives. Composed of emery altogether would be too expensive. A. Mix fine sharp furnace sand with hydraulic cement.

(4) A. McC. writes: I notice in the number for December 13, 1879, on page 387 (11), J. S. P. asks about muriatic acid for tinners' use. For a soldering fluid I have in my laboratory work found the following excellent. Dissolve 32 grammes zinc in sufficient muriatic acid, and add 22 grammes sal ammoniac (ammonium chloride), and evaporate to dryness. Dissolve the resulting salt in water, and filter. This will answer for tin, zinc, and brass excellently, the parts to be soldered scarcely needing to be cleaned when this is used.

(5) H. L. S. asks which side of a belt should run in contact with the pulley? A. The grain side next the pulley drives best and wears best.

(6) J. H. asks: Will you tell me the size of the cylinder of engine for boiler described below? Boiler horizontal, 7 feet long, 28 inches diameter, 14 4-inch tubes 4 feet long, height of boiler 3 feet, dome 15 by 18 inch to burn wood. A. It depends in part on the speed of the engine; probably a 5 inch cylinder and 6 to 8 inches stroke would answer.

(7) H. P. T. asks: Can sufficient gas be had through an ordinary dwelling house gas pipe (¼ inch), with three Bunsen burners, to evaporate (through the aid of a coil boiler) sufficient water to furnish steam necessary for a 1-6 to ¼ horse power engine? A. Yes.

(8) W. L. writes: A blower being placed in a boat aft of a sail, blows hard against the same; which way will the boat move? A. As action and reaction are equal, we doubt if the boat would move either way from the mere blowing.

(9) J. W. D. asks: Was there an iron vessel or gun boat built or launched from or about the foot of 14th street, North River, by the Delamater Iron Works at or about the time of the war? A. Yes, the Matanzas.

(10) P. H. D. asks how to find the diameter of a small wheel of a given number of teeth to gear into a larger wheel of given diameter and given number of teeth. For example, what is the diameter of a wheel which has six teeth, to gear into a wheel, two inches in diameter, with sixty teeth? A. The ratio of the diameters of the two wheels is the same as that of the number of their teeth. If one wheel has 6 teeth and the other 60, the diameter of the small wheel is 1-10th the large one.

(11) J. V. asks for the rule for finding the blow struck by a moving body. Is it the weight of the body by the square of its motion, and is the motion the motion in seconds or in minutes, that is, the initial velocity? A. Formula given by Molesworth is $F = V W$, F = force of blow in tons. V = velocity per second due to fall. W = weight of ram in tons.

(12) R. B. S. asks: What is the difference between levigation and trituration? A. Levigation is the process by which substances are reduced to a state of minute division by rubbing them between two hard surfaces while the substances are formed into a paste with water. Trituration is the comminution of substances without the aid of a liquid.

(13) T. B. asks: 1. Can old Bessemer steel rails be worked over and made into new rails? A. Yes. 2. Which side of a leather belt should be worked to the pulley, the rough or smooth side? A. The grain or smooth side.

(14) A. D. F. asks for a good recipe for waxing floors, and how it is applied. A. Stir 25 parts of shredded yellow wax into a hot solution of 12 parts of pearl ash in soft water. Keep the mixture well stirred until effervescence ceases, then remove it from the fire and stir in 12 parts of finely ground dry yellow ocher. It may now be poured into cans to cool. When wanted for use one part of it is dissolved in five parts of boiling water. Apply warm with a paint brush. It dries in a few hours, when the floor is polished with a floor brush and afterward wiped with a woolen cloth. It is said that this wax coating will last for six months with ordinary use.

(15) H. D. K. asks for a description of a powerful battery about the size of a thimble, to be used in some electric jewelry. A. The essential parts of such a battery are, two plates of carbon, one plate of well amalgamated zinc, and a solution made by dissolving 2 parts of bichromate of potash in 20 parts of hot water, and when cold adding 1 part of sulphuric acid. The zinc plate is placed between the two carbon plates, leaving a space on each side. The carbon plates are connected together and with one of the conducting wires, the zinc plate is connected with the other conducting wire. The zinc and carbon plates may be attached to a rubber stopper fitted to a small jar or bottle containing the bichromate solution at the bottom below the ends of the plates, and the solution may be brought into contact with the plates by turning the bottle down on its side. This battery works powerfully for a short time, but the solution soon becomes exhausted and must be replaced.

(16) F. Y. A. asks: How am I to judge pure lard oil? That which I usually get gums. A. Compare color, smell, taste, specific gravity (=0.9000), and

reaction with a few drops of nitric and sulphuric acids, bichromate of potassa, and caustic soda respectively, with a standard sample of the pure oil.

(17) C. & Co. ask: What chemicals are used in the dyeing of Pampas grass, red, blue, yellow, etc.? A. Use warm aqueous and alcoholic solutions of any of the soluble aniline dyes.

(18) R. M. asks: What book would you advise for new beginners in electroplating, brass, copper, tin, silver plating, nickel, etc.? A. Consult Fesquet's "Electro-Metallurgy;" Napier's "Electro-Metallurgy;" Roseleur's "Galvanoplastic Manipulations."

(19) Z. C. writes: In No. 21 of the current volume of the SCIENTIFIC AMERICAN, you give a receipt for making a "copying pad" as follows: 1 oz. Cooper's gelatine to 6½ fluid oz. glycerine. I undertook to make a pad, following the receipt to the letter, and found that the pad would not abstract any ink (aniline according to the receipt) from a piece of paper. I then heated the mixture again and added another ounce gelatine. This time the pad would give four good copies, and only six which were at all legible. Then I added ½ oz. more gelatine, and can now take 15 good copies. A. You will have better results if you use more glycerine, as directed, and expel all or as much of the water as possible by heating over a salt water bath for some time. Pads made according to the receipt have yielded upwards of a hundred and fifty distinct copies.

(20) J. K. asks for some good stove polish that can be prepared at home—something that will not burn off. A. Common stove blacking is graphite or plumbago reduced to a fine powder by grinding. We know of nothing better. 2. What will remove stains from stove zinc, and restore its look of newness? A. The planished surface is imparted by rolling the warm sheet metal; the finish cannot readily be restored. The surface may be cleaned and brightened by moistening it with a strong solution of oxalic acid in water, and drying with sawdust, or better, with whiting.

(21) H. B. asks (1) for a receipt for making self-raising flour. A. The following are the compositions of several of these powders in extensive use: 1. Bicarbonate soda, 28 oz.; burnt alum, 19 oz.; starch, 57 oz. 2. Bicarbonate soda, 26¼ oz.; sesquicarb. ammonia, 2¼ oz.; starch, 47 oz.; burnt alum, 26¼ oz. 3. Bicarbonate soda, 31 oz.; burnt alum, 20¼ oz.; starch, 30 oz. 2. For cementing leather on friction pulleys? A. Good glue is commonly employed, we believe.

(22) G. O. asks how to clear a warehouse of weevil. They live on the grain in the cracks of the floor when the house is empty. A. Dalmatian (Persian) insect powder, when well distributed, does very well.

(23) B. F. M. asks: What chemicals are used for taking the solar spectrum in colors? Can you tell me a compound that will turn yellow in daylight, also one that will turn red? A. Photographing in the natural colors has never been accomplished by direct means, although monochromatic prints in several colors have been obtained. The results in color photography by indirect means, attained by Vogel, Vidal, Alfred, and others have been noticed in the back numbers of the SCIENTIFIC AMERICAN. Consult some late work on photography and photographic chemistry. See pp. 133 and 155, Vol. 35, SCIENTIFIC AMERICAN.

(24) J. W. asks how phosphor bronze is formed, and how the phosphorus is added to the metal, and how many ounces is given to a pound of metal. A. Wrap the phosphorus—about 1-10th of one per cent—in foil, and force it by means of an earthen rod having a bell-shaped cavity at the end, beneath the surface of the molten metal (bronze). The phosphorus must be free from moisture, and great care must be observed in handling it to avoid accident.

(25) R. H. B. writes: A correspondent of the *Derrick* states that gold was extracted from petroleum oil in New York city. Does petroleum contain gold, if so, in what quantity? A. According to Mr. John Turnbridge, of Newark, New Jersey, small quantities of gold have been found in petroleum residues. See article "Petroleum and Gold," p. 277, No. 24, Vol. 30, SCIENTIFIC AMERICAN.

(26) C. C. asks (1) for the name of the acid for testing gold and silver. A. The acid used with the touchstone is pure nitric acid slightly diluted. 2. What is the best material for polishing steel and brass? A. Emery flour and oil are in general use.

COMMUNICATIONS RECEIVED.

On Collisions at Sea. By W. L.
Fish Story. By C. F. L.
On War Vessels. By J. L. R.
On Panama Ship Railway. By W. E. A.
On Ice Boats. By L.
On Ice Boats. By A. F. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 2, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Advertising device, J. J. Cohen 222,308
Aging spirits and alcoholic liquids, J. L. Martin ... 222,235
Agricultural implement, Neal & Atwood 222,156
Alumina and carbonate of soda, manufacturing, C. V. Petraeus 222,132, 222,153, 222,154
Annunciator, pneumatic, C. E. Zindars 222,340
Bale tie, J. M. Camp 222,341
Bed bottom, A. D. Campbell 222,177
Bedstead fastening, P. Forg 222,129
Belaying device, A. Stoddard 222,326
Bell, door, J. B. Richard 222,307
Blank heating furnace, G. H. Webb 222,333
Blind fastening, window, N. M. Hutton 222,136
Bolt extractor, J. McKeever 222,280
Boot and shoe counters, die for shaping, J. Kieffer 222,293
Boot treeing machine, J. B. Crisp 222,249
Boots and shoes, metallic standard and last for, S. Ross, Jr. 222,157
Bosom board, F. M. Wright 222,343
Bottle stopper, U. C. Rounsilint 222,185
Bracelets, metallic stock for, G. H. Boyce 222,170
Bridge gate, automatic draw, W. F. McGregor 222,146
Broom winding machine, C. E. Lipe 222,141
Brush, Wadsworth & Smith 222,165
Buckle, harness, G. D. Mosher 222,150
Building block, J. Thompson 222,211
Bung, F. Tuchfarber 222,164
Bung and bush, T. T. Brown 222,233
Buoy for indicating sunken vessels, Wardwell & Currier 222,215
Bushing, wooden, E. C. Gillette 222,169
Button and fastening, J. H. Robertson 222,300
Button, boot and shoe, W. S. Boyd, 2d 222,136
Button, collar, S. J. Allen 222,172
Button or stud, H. S. Banister 222,229
Button, separable, W. Bourke 222,233
Cake machine, soft, J. T. Trott 222,212
Calculator, W. M. Briggs 222,126
Car brake, Sinn & Studer 222,317
Car brake, S. P. Tallman 222,163
Car brake and starter, T. L. Webster 222,218
Car heating apparatus, railway, J. B. Collin 222,246
Car starter, A. Lemaire-Douchy 222,268
Cars, device for supplying fresh air to, J. B. Collin 222,247
Cars, transferring and moving, M. D. Hays 222,274
Cartridge, A. Tillmes 222,323
Cartridge capping implement, C. M. Spencer 222,162
Caster, G. S. Andrews 222,226
Chain hook, A. Sanford 222,203
Cheese curd sink, H. C. Markham (r) 8,997
Churn, L. D. Hevey 222,188
Churn dasher, A. A. Woodson et al. 222,170
Churn power, J. W. Miller 222,147
Clay, etc., machine and process for disintegrating, J. C. Anderson 222,226
Cloth cutting machine, chenille, Havers & Gooch 222,275
Coffee roaster, J. Greybowski 222,131
Collar, horse, J. H. Snyder 222,328
Coloring matter, green, O. G. Doebner 222,257
Cooking utensil, J. McMurray 222,296
Cornet, Conn & Dupont 222,240
Cotton scraper, chopper, and dirter, Force & McConnell 222,265
Cremation purposes, building for, O. Kraus 222,283
Curtain fixture, A. S. Shaw 222,204
Dental engine hand piece, R. B. Donaldson 222,181
Deodorizing commode, D. C. Hartman 222,133
Derrick, steam hoisting, C. C. Lyman 222,143
Desk, school, D. Jackson 222,190
Door check, A. F. Wittich 222,335
Draught equalizer, W. T. Burrows 222,240
Draught equalizer, Utterback & Rains 222,233
Drawer pulls, device for attaching, G. W. Tucker 222,212
Drilling machine, O. Smith 222,321
Elevator, B. Slusser 222,319
Embossed fabrics, manufacture of, F. Walton 222,214
Explosive compound, E. J. Williams 222,169
Eyeglasses, nose clamp for, A. C. Sletben 222,121
Fanning mill, E. M. Gilbert 222,130
Fare box, J. B. Slawson (r) 8,998
Farm engines, fire box attachment for, H. Gillett 222,270
Feather renovator, C. A. Akerly 222,223
Feathers, E. B. Dyer 222,128
Firearm, revolving, D. B. Wesson 222,167, 222,168
Fluids, preserving and drawing, J. Wolf 222,220
Fruit and vegetable cutter, T. K. Knapp 222,284
Furnaces, converter, etc., fireproof compound for lining, E. F. Althens et al. 222,224
Galvanic and medicated pad, combined, H. E. Hunter 222,276
Game board, W. Harmon 222,272
Garment hanger, B. England 222,183
Gas motor, liquid, A. Gatson 222,134
Gas pressure governor, M. Loes 222,290
Grain binder, W. H. Berry 222,231
Grain drill, J. A. Shepherd 222,316
Grain, machine for separating metal from, C. W. Levalley 222,191
Grate bar, Van Patten & Perry 222,165
Handcuff, R. B. Daley 222,252
Handles of celluloid and similar materials on cutlery, etc., moulding, Beals & Thomas 222,229
Harness, D. S. Shaffield et al. 222,315
Harness, F. D. Thurman 222,331
Harrow, J. Rogers 222,312
Hat and cap sweat band, T. W. Bracher 222,236
Hatch closer, J. W. Kuhl 222,286
Hatchway, elevator, Murdock & Beach 222,198
Hay loader and press, combined, J. A. Shull 222,206
Headers, apparatus for guiding, J. Steves 222,210
Hoe, plantation, R. N. Gregg 222,165
Hoop sawing and finishing machine, J. Michaels 222,297
Horse rake, S. C. Brinser (r) 8,993
Horses, appliance for protecting the fetlock sinews of, Lehmann & Borendt 222,289
Hose and pipe coupling, W. J. Stevens 222,326
Hub, vehicle wheel, A. McKellar 222,294
Hydrocarbon burner, R. S. Robertson 222,156
Ice tongs, pick, and hatchet, combined, W. S. Hill 222,186
Inkstand, R. C. Nichols 222,301
Key, H. H. Elwell (r) 8,994
Knit fabrics, tubular, R. L. Storrs 222,327
Knobs, manufacture of door, W. S. Backus 222,351
Lampblack, apparatus for making, H. B. Winslow 222,337
Lamp globes, cap for, H. H. Halbert 222,180
Lantern, W. E., J. F., & E. R. Mason 222,145
Lathe, button, A. A. Smith 222,341
Locomotive pilot, F. F. Mortimer 222,149
Lyre, C. Kunkel 222,128
Malt liquors, apparatus for drawing and preserving, J. Neumann 222,300
Measuring can, liquid, Fitzgerald & McInnes 222,262
Meat, device for salting, T. J. Gissle 222,267
Meat mincing machine, Steffe & Knight 222,209
Medicated beverage, J. G. Holland 222,187
Merchandise elevator, F. Imburst 222,137
Mower, M. H. Johnston 222,280
Nut lock, Jones & Ross 222,281
Nut lock, N. F. Wynkoop 222,220
Oils, apparatus for storing, measuring, and drawing, R. F. Wilder 222,332
Paper folding machine, Cole & Eisenlord 222,245
Paper, machine for the manufacture of carbon or manifold, Francis & Braidwood 222,266
Paper from coniferous trees, making, J. M. Allen 222,171
Picture frame, H. B. Johnson 222,279
Pillow sham frame and holder, J. B. Adams 222,222
Planter and drill, corn, J. L. Roberts 222,311
Planter, corn, G. W. & F. P. Morphey 222,197
Planters, check row dropper attachment for corn, W. B. Dee 222,779
Plow, A. C. Schram 222,313
Plow, gang, F. S. Davenport (r) 8,996
Plows, harrow attachment for corn, G. W. & G. L. Howell 222,275
Polishing machine, J. Stever 222,325
Potassium, apparatus for the manufacture of ferrocyanide, H. Bower 222,173
Potato digging machine, Nevinger & Seldon 222,100
Printing and other machinery, stopping and reversing mechanism for, W. Scott 222,159
Printing machine, box, P. B. H. Smith 222,320
Printing machine, card, I. Robbins 222,309
Pruning implement, Cole & French 222,244
Puddling vessels, cooling circulation about rotating, W. & G. H. Sellers 222,314
Pump, J. R. Cushier 222,250
Pump valve box, J. Watson 222,217
Railway, portable, J. K. Davis 222,254
Railway rail, S. Nicholls 222,302
Railway rails, machine for curving, Duncan & Jones 222,182
Railway switch, J. B. Carey 222,127
Railways, deadening noise on elevated, G. E. Bendix 222,230
Rectifying machine, G. W. Kidd 222,282
Reel for coiling metal strips, Miner & Reveleander 222,148
Refrigerating chamber, etc., G. H. Mactsel 222,144
Refrigerator, G. C. Addison 222,221
Refrigerator, J. J. Bate 222,121, 222,122, 222,123
Rendering apparatus, B. A. Husbands 222,277
Roach trap, J. Herschman 222,184
Rope coupling metal, P. Brady 222,125
Ruling machine, paper, E. W. Blackhall 222,174
Saw tooth, inserted, R. H. Osgood 222,304
Scales, weighing, L. G. Woolley 222,341
Scarf, T. J. Flagg 222,264
Screws, machine for making metal, T. F. Carver 222,178
Self-heating iron, S. A. Case 222,179
Sewing machine, double chain stitch, J. H. Mooney 222,298
Sewing machine quilting attachment, J. W. Starmer 222,209
Sewing machine table, D. Soltjer 222,322
Shaft prop, buggy, J. T. Baker 222,227
Sheet metal cans, die for making, J. W. Farrell 222,263
Shock or jar recorder, T. L. Luders 222,292
Show box, J. Loeb 222,291
Sickle holder for grinding machines, L. D. Dana 222,253
Sifter, flour, F. G. Ford 222,305
Signal light, C. D. Gatman 222,268
Sink outlets, cover for, F. Dowdican 222,259
Sleeve adjuster, S. A. Feit 222,302
Snap hook, J. Stapleton 222,324
Soldering iron heaters, fire pot for, J. T. Brown 222,237
Spinning and weaving rooms, electric heat and vapor governor for, J. M. Bradford 222,234
Spinning frame, G. E. Taft 222,328, 222,329
Square, perspective, T. B. M. Hamilton 222,271
Staples, machine for making, J. Shellenberger 222,205
Stirrup, L. Pullum 222,155
Stone dressing and cutting machine, A. McDonald 222,194
Stone dressing tool, L. C. Gilmore 222,269
Stove back, adjustable, P. H. Follows 222,193
Stove leg support, Cutting & Leland 222,130
Stove pipe thimble, C. C. & F. Campbell 222,142
Supporting platform, W. M. Conger (r) 8,995
Target, ball, J. P. Newbold 222,301
Telephone, carbon, G. M. Phelps 222,302
Telephone, magnet, C. Ader 222,118
Telephone signal, visible, C. Ader 222,119
Telephones, switch for electric speaking, G. M. Phelps 222,201
Telescopes and microscopes, eye piece and objective for, E. Gundlach 222,132
Theater appliance, S. Mackaye 222,142
Thill coupling, H. Albers 222,120
Thill coupling, R. B. Murdock 222,195
Thrashing machine, J. P. Smith 222,319
Tiles and other articles in imitation intarsia, manufacture of, F. Koshul 222,286
Toy gun, S. C. Washburne 222,216
Umbrella tip cup, G. W. McClintock 222,193
Vehicle spring, S. W. Ludlow 222,193
Ventilator, T. Simmons 222,207
Violin, C. Kreutzer 222,287
Wagon draught attachment, L. Pullian 222,306
Wagon dumping, B. H. Sherar 222,160
Washing machine, W. P. Brooks 222,336
Watch case, A. Breese 222,236
Water drawing and filtering apparatus for cisterns, etc., J. B. Lindsay 222,140
Water elevator, R. L. Browning 222,239
Water meter, T. Moriarty 222,299
Water-tight coupling for goose necks, flexible, T. J. McGowan 222,295
Wells, polish rod adjuster for Artesian and other, O. B. Wickham 222,336
Willow withes, machine for splitting and shaving, J. Popping 222,305
Windmill, T. Dewees 222,256
Windmill, S. M. Rittenhouse 222,310
Windmill, H. M. Wood 222,340
Windwheel, L. B. Wallis 222,334
Yeast cakes, machine for making, O. S. Hoffman 222,135
Zithers, C. Kunkel 222,139

DESIGNS.

Brass tubing, W. T. Marsetran 11,330
Knitted fabric, C. E. Bean 11,328
Plug tobacco, Hancock & Whitlock 11,332
Printing types, Pettit & Buss 11,331
Sleigh bells, G. W. Goff 11,329
Woven fabric, E. Maertens .... 11,333 to 11,335
Water coolers, C. D. Dehommer 11,326

English Patents Issued to Americans.

From November 28 to December 2, 1879, inclusive.

Ash sheets, etc., J. P. Swoikert, Philadelphia, Pa.
Boot and shoe soles, machine for channeling, M. A. C. Holmes, Newport, R. I.
Crushers for ore and rock, C. Forster, Pittsburg, Pa.
Drums and pulleys, James & Jackson, Reading, Pa.
Emery wheels, manuf. of, F. Copeland, Boston, Mass.
Excavating, submarine, R. Stone, New York city.
Printing press feeding apparatus, C. Ellery, Albany, N. Y.
Tables, extending, etc., J. D. Brewington, N. Y. city.
Telephones, G. D. Clark et al., Chicago, Ill.
Telegraph wires, insulating, J. Evans, Philadelphia, Pa.
White lead, manuf. of, G. T. Lewis et al., Phila., Pa.
Wire, machine for rolling, C. H. Morgan, Worcester, Mass.

BAIRD'S BOOKS, FOR PRACTICAL MEN.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo; a Catalogue of Books on DYEING, CALICO PRINTING, WEAVING, COTTON and WOOLEN MANUFACTURE, 4to; Catalogue of a choice collection of PRACTICAL, SCIENTIFIC, and ECONOMIC BOOKS, 4to; List of Books on STEAM AND THE STEAM ENGINE, MECHANICS, MACHINERY, and ENGINEERING, 4to; List of important Books on METALLURGY, METALS, STRENGTH OF MATERIALS, CHEMICAL ANALYSIS, ASSAYING, etc., 4to; List of Books on MINING, MINING MACHINERY, COAL, etc., 4to; two Catalogues of Books and Pamphlets on SOCIAL SCIENCE, POLITICAL ECONOMY, BANKS, POPULATION, PAUPERISM, and kindred subjects; also a Catalogue of recent additions to our stock of PRACTICAL SCIENTIFIC AND TECHNICAL BOOKS, sent free to any one who will forward his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.

STEAM HEATING APPARATUS

WANTED.—A 60 IN. LATHE, 20 FT. BED; also, 60 in. Planer, to plane 20 ft. long; new or second-hand. State price, when can deliver, and maker's name. Address P. O. Drawer No. 5046, Boston, Mass.

A 10 IN. x 18 IN. HORIZONTAL ENGINE; 8 in. x 10 in. do., 8 in. x 8 in. Boat Engine, all new; for sale cheap. Apply to W. WALTER, 543 West 39th Street, New York.

MACHINERY WANTED, NEW OR SECOND HAND, for manufacturing Tacks, Finishing Nails, Brads, and Small Rivets. Address Manufacturer, Box 773, N. Y. city.

RENEW The SCIENTIFIC AMERICAN ($3.20), with the Phrenological Journal ($2.00), both a year for $4.20. Address S. R. WELLS & CO., Publishers, 737 Broadway, New York. Send postal card for last number of Phrenological as specimen.

Dead Stroke Power Hammers

are superior to all others for forging and die work. Over 300 now in use. Manufactured by

PHILIP S. JUSTICE,
14 North 5th Street, Philadelphia, Pa.

HOW TO LEARN SHORT HAND. An improved system of short hand writing, arranged especially for use without the aid of a teacher. The latest, simplest, and most practical. By A. M. Baker. A complete instructor, only 25c. by mail. Address S. R. WELLS & CO., Publishers, 737 Broadway, New York.

Steam Fitters' & Plumbers' Supplies.
STURTEVANTS' FAN BLOWERS.
ALBERT BRIDGES, 46 Cortlandt Street, New York.

U. S. ENGRAVING WORKS

ICE HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.

BI-SULPHIDE OF
CARBON.
Manufactured by E. R. TAYLOR, Cleveland, Ohio.

$1,000 to $3,000 Per year made by our Agents. $3.00 worth of goods free. Send stamp for circulars. NITELA MAN'F'G Co., Cleveland, O.

For improved Blind Staples and Drivers, Rod Cutters, Blind Stile Borers, address B. C. DAVIS, Binghamton, N. Y.

A 1 ENGINE FOR SALE.
Horizontal Slide Valve Engine, Graduated Cut-off Cylinder 24 in. bore by 36 in. stroke, 8 in. Judson Governor, Lever Throttle Valve, 4 in. Hammered shaft 12 ft. long—complete. Was built by owners for their own use, with sole reference to durability, strength, and economy of fuel. Will be sold reasonably. Address P. O. Drawer 994, Buffalo, N. Y.

WANTED.—TO BUY OR WORK ON Royalty, a few small patented articles. Have best facilities for introducing them. Reference given. Address PATENT, Mount Winans, Md.

KNOW THYSELF.

THE untold miseries that result from indiscretion in early life may be alleviated and cured. Those who doubt this assertion should purchase the new medical work published by the PEABODY MEDICAL INSTITUTE, Boston, entitled THE SCIENCE OF LIFE, or, SELF-PRESERVATION. Exhausted vitality, nervous and physical debility, or vitality impaired by the errors of youth, or too close application to business, may be restored and manhood regained.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jeweled medal by the National Medical Association. It contains beautiful and very expensive engravings. Three hundred pages, more than 50 valuable prescriptions for all forms of prevailing disease, the result of many years of extensive and successful practice, either one of which is worth ten times the price of the book. Bound in French cloth; price only $1, sent by mail postpaid.

The London Lancet says: "No person should be without this valuable book. The author is a noble benefactor."

An illustrated sample sent to all on receipt of 6 cents for postage.

The author refers, by permission, to JOS. S. FISHER, president; W. I. P. INGRAHAM, vice-president; W. PAINE, M.D.; C. S. GAUNTT, M.D.; H. J. DOUCET, M.D.; R. H. KLINE, M.D.; J. R. HOLCOMB, M.D.; N. R. LYNCH, M.D., and M. R. O'CONNELL, M.D., faculty of the Philadelphia University of Medicine and Surgery; also the faculty of the American University of Philadelphia; also Hon. P. A. BISSELL, M.D., president of the National Medical Association.

Address Dr. W. H. PARKER, No. 4 Bulfinch Street, Boston, Mass. The author may be consulted on all diseases requiring skill and experience.

HEAL THYSELF.

Baker Rotary Pressure Blower,
(FORCED BLAST.)

Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA.

NEW YORK BELTING AND PACKING COMP'Y.
The Oldest and Largest Manufacturers of the Original

Emery Wheel.

SOLID VULCANITE
EMERY WHEELS.

All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.

Address NEW YORK BELTING AND PACKING CO.,
JOHN H. CHEEVER, Treas. NEW YORK.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
235 BROADWAY, NEW YORK.

PRINCIPLES OF HORSE SHOEING.—By Geo. Fleming, V.S. A paper describing the proper method of shoeing horses so that the animal's feet may be kept always healthy and sound. How much the walls of the hoof should be reduced, and how the operation should be performed; the kind of shoes that should be selected; how they should be fitted; the number and size of nails that should be used, and how the face of the hoof should be treated. Followed by a description of a modified form of the "Charlier" method as successfully followed by the author for many years. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 203. Price 10 cents. To be had at this office and from all newsdealers.

BARNES' PATENT FOOT POWER MACHINERY,

CIRCULAR SAWS, SCROLL SAWS, LATHES, FORMERS, MORTISERS, TENONERS, &c., for actual workshop business.

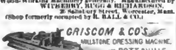
COMPLETE OUTFITS for Mechanics and Amateurs.

MACHINES ON TRIAL IF DESIRED.

Say where you read this, and send for Descriptive Catalogue and Price List. W. F. & JOHN BARNES, Rockford, Ill.

Wood-Working Machinery,

such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON, 26 Salisbury Street, Worcester, Mass. (Shop formerly occupied by R. BALL & CO.)



Grain Speculation!

Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., Chicago, Ill., for Circulars.

$10 to $1000 Invested in Wall St. Stocks makes fortunes every month. Book sent free explaining everything. Address BAXTER & CO., Bankers, 7 Wall St., New York.

PATENT
COLD ROLLED
SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburg, Pa.
190 S. Canal Street, Chicago, Ill.

Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass. Geo. Place Machinery Agency, 121 Chambers St., N. Y.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

RAPID
ADDITION!
Wonderful Invention!

ART of Adding Figures from Left to Right; or from Middle either way; or six columns at one time. Done as Quick as Thought! Sent to any address on receipt of Price, 50 Cents in postage stamps.

W. F. MERRIMAN, Batavia, N. Y.

SNOW'S DRY TRANSFER INK

DISSOLVES IN WATER. Anything written or drawn with it can be transferred in one minute to a GELATINE PAD, and 100 copies printed by pressure of the hand. Package to make one fluid ounce, postpaid, sealed, 25 cents, with enough of

TRANSFER "GLYCERJEL"

To make postal card size of transfer surface. Melt and cast it in a dish or on glass. Put up in cans, ½ lb., for 25 cts.; ½ lb., 50 cts.; 1 lb., 75 cts.; and 2 lbs., $1.00, by express. ½ lb. makes Pad of letter size. AGENTS WANTED. SNOW & CO., Watertown, Mass.

BRADFORD MILL CO.
Successors to Jas. Bradford & Co.,
MANUFACTURERS OF
French Buhr Millstones,
Portable Corn & Flour Mills,
Smut Machines, etc.
Also, dealers in Bolting Cloths and General Mill Furnishings.
Office & Factory, 158 W. 2d St.
CINCINNATI, O.
J. R. Stewart, Pres. W. R. Dunlap, Sec.
PRICE LISTS SENT ON APPLICATION.

JAMES ECCLES,

General Machinist, Inventor, and Maker of the Patent Quadruple Screw Power Press
For the use of Printers, Hosiery Manufacturers, and all others who desire great and uniform pressure.
2423 Lombard St., Philadelphia, Pa.
ESTABLISHED 1850.

"IT DRIVES TROUBLE AWAY."

The Great Family Paper.

THE NEW YORK LEDGER
FOR THE NEW YEAR, 1880.

We have had a long and successful experience in publishing a family literary paper.

We propose for the coming year, 1880, to make the *Ledger* just as good as we can make it—better than ever before.

The ability to do this results from our long practice, and the generous support which our almost countless readers have furnished us, out of which we can richly afford to pay the highest price for the very best writers, new and old.

The stories for the coming year will be by the most popular of our old writers and all whom we consider the best of the new writers.

The *Ledger*, for over twenty-five years, has employed the best writers in the country. It not merely contains the most interesting stories, sketches, and essays; but original articles from the most distinguished clergymen, statesmen, and scholars. For the coming year, we shall have articles every week from the pens of the REV. DR. JOHN HALL, of New York, and the REV. DR. THOMAS M. CLARK, Bishop of Rhode Island. This will be in addition to the usual variety from our old and popular contributors, including JAMES PARTON, PROF. PECK, MARY KYLE DALLAS, DR. ENGLISH, MRS. SOUTHWORTH, JUDGE CLARKE, MR. COBB, MISS DUPUY, CARLOTTA KINGSLEY, and many others.

All manner of interesting and vital questions will be answered in our columns.

The *Ledger* will continue to be THE GREAT FAMILY PAPER, full of life and interest.

It offers at once one of the cheapest, greatest, and most lasting of pleasures.

OUR TERMS FOR 1880.—POSTAGE FREE.

Single copies, $3 per annum; four copies, $10, which is $2.50 a copy; eight copies, $20, postage free. The party who sends us $20 for a club of eight copies (all sent at one time), will be entitled to a copy free. Postmasters and others who get up clubs, in their respective towns, can afterwards add single copies at $2.50. No subscriptions taken for a less period than one year. When a draft or money order can conveniently be sent it will be preferred, as it will prevent the possibility of the loss of money by mail. Remember that the postage on the *Ledger* to all parts of the country will be paid by us, so that our subscribers will have no postage to pay.

We employ no travelling agents. Address all communications to

ROBERT BONNER, Publisher.
Corner of William and Spruce Sts., New York.

Now if you want a paper that has something in it—something to amuse, to entertain, to instruct—the best and truest love stories, sound, wholesome doctrines about right and wrong, and an infinite variety of interesting, agreeable, and diverting articles, subscribe for the *Ledger*. The cost is nothing compared to the value of what you get.

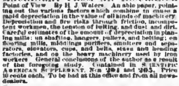
BLAKE'S STONE AND ORE BREAKER AND CRUSHER.

For breaking hard and brittle substances to any size. Endorsed by the leading Mining, Manufacturing, and Railroad corporations in the United States and Foreign Countries. First Premium wherever exhibited, and hundreds of testimonials of the highest character.

Indispensable for making best McAdam Roads, Ballasting of Railroads, Crushing the hardest Ores, Stone for Concrete, etc., etc. Prices greatly reduced.

Address BLAKE CRUSHER CO., New Haven, Conn.

MACHINERY FROM AN INSURANCE Point of View. By H. J. Waters. An able paper, pointing out the various factors which combine to cause a rapid depreciation in the value of all kinds of machinery. Depreciation and fire risks through friction, incompetent workmen, the tension of belting, and dust and dirt. Careful estimates of the amount of depreciation in planing mills; on shafting, hangers, pulleys, and belting; on flouring mills, middlings purifiers, smutters and separators, elevators, cups, and belts, stave and heading factories, and on the heavy machinery used by iron workers. General conclusions of the author as a result of the foregoing study. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 204 and 205. Price 10 cents each. To be had at this office and from all newsdealers.



Small Tools of all kinds; GEAR WHEELS, parts of MODELS, and materials of all kinds. Catalogues free. GOODNOW & WIGHTMAN, 176 Wash'n St., Boston, Mass.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N. Y., who control the patent for Green's American Driven Well.

To Electro-Platers.

BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with Books of Instruction for Gold, Silver, or Nickel Plating. THOMAS HALL, Manufacturing Electrician, 19 Bromfield Street, Boston, Mass. Illustrated Catalogue sent free.

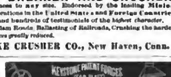
Pond's Tools,
Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

READY ROOFING
FOR STEEP OR FLAT ROOFS
SEND FOR SAMPLE AND CIRCULAR
W. H. STEWART
74 COURTLAND ST. NEW-YORK.

HARDWOOD LUMBER
AND
VENEERS.

Mahogany, Rosewood, Satinwood, French and American Walnut, Burl Veneers, Hungarian Ash, Amaranth, etc., etc. Manufacturers will find our stock unusually choice and prices low. Full line of Rare and Fancy Woods planed for amateur's use.

GEO. W. READ & CO.,
186 to 200 Lewis St., New York.

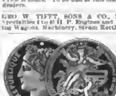


JOHN R. WHITLEY & CO.
European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E.C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

A GOOD PLAN. Combining and operating many orders in one vast sum has every advantage of greatest capital, with best skilled management. Large profits divided pro rata, on investments of $25 to $10,000. Circular, with full explanations how all can succeed in stock dealings, mailed free. LAWRENCE & CO., 55 Exchange Place, New York.

ICE AND ICE HOUSES—HOW TO MAKE Ice ponds; amount of ice required, etc., and full directions for building ice-house, with illustrated plan. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 53. Price 10 cents. To be had at this office and of all newsdealers.

GEO. W. TIFFT, SONS & CO., BUFFALO, N. Y., Specialties 1 to 40 H. P. Engines and Boilers, Sugar Cooling Wagons, Machinery, Steam Kettles, etc.



Paris, . . 1878
Australia, 1877
Phila., . . 1876
Santiago, 1875
Vienna, . 1873

J. A. FAY & CO'S
WOOD WORKING MACHINERY

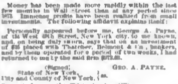
was awarded at the Paris Exposition over all competitors THE GOLD MEDAL OF HONOR. Also highest award at Phila., Santiago, Australia, and Vienna. It is

Original in Design. Simple in Construction. Perfect in Workmanship. Saves labor. Economizes lumber, and Increases products of the highest standard of Excellence.

Railroad, Furniture, and Agricultural Implement Shops, Planing Mills, etc., equipped at short notice, and the lowest cash prices. Send for circulars.

J. A. FAY & CO., Cincinnati, Ohio, U. S. A.

Has More Good Points,
Does More and Better Work,
Takes Less Power,
Than any Hammer in the World.
BRADLEY & COMPANY,
SYRACUSE, N.Y.



A REVOLVER GIVEN AWAY.

The largest and costliest Catalogue of Revolvers, &c., in the world, containing exact pictures of nearly every Revolver in existence; a valuable book of reference in itself. Sent free to any address. $6.00 Revolvers reduced to $2.75. Colt Revolvers, $2.75. Biggest bargains ever known. A CHANCE FOR ONE MAN IN EVERY TOWN IN THE UNITED STATES TO GET A $6 REVOLVER FREE. Address Eeerr Repeating Arms Company, 57 Washington St., Boston, Mass., U. S. A.

ARCHÆOLOGY. At sale, a large treasure at the Red Sea. Address F. A. DE LA NUX, West Oakland, Cal.

A
FORTUNE QUICKLY MADE.

Money has been made more rapidly within the last few months in Wall Street than at any period since 1873. Immense profits have been realized from small investments. The following affidavit explains itself:

Personally appeared before me, George A. Payne, of 154 West 48th Street, New York city, to me known, and, on being duly sworn, says that on an investment of $25 placed with Thatcher, Belmont & Co., bankers, and by them operated for a period of two weeks, I had returned to me by the said firm $373.80.

(Signed) GEO. A. PAYNE.

State of New York, City and County of New York, } ss.

Sworn before me this 22d September, 1879.

J. B. NONES, Notary Public, 8 Duane Street, N. Y.

Thatcher, Belmont & Co., accept subscribers on their 1 per cent. margin or in their concentration of capital, whereby a number of small sums, from $10 upwards, are aggregated and stocks operated. Latest Wall Street information sent free upon application by Messrs. Thatcher, Belmont & Co., Bankers, P. O. Box 1307, or 44 Broad Street, New York.

THE SKINNER PORTABLE & STATIONARY ENGINES BOILERS & GOVERNORS
FIRST CLASS & ECONOMICAL. SKINNER & WOOD, ERIE, PA.
SEE ILLUSTRATED ADVERTISEMENT

THE SUTRO TUNNEL. BY ADOLPH Sutro. An interesting address, giving the history of this celebrated mining tunnel, from its inception up to the present time, and the reasons that led to the undertaking; describing the methods that have been used in construction, the difficulties that have been encountered, and the obstacles in progress that have been met with; and prefaced by a valuable account of the discovery of the Comstock lode, and of the geological formations of the gold and silver deposits of California. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 205. Price 10 cents. To be had at this office and from all newsdealers.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 2. [NEW SERIES.] NEW YORK, JANUARY 10, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

THE TELEPHONIC CENTRAL OFFICE SYSTEM.

It is difficult to conceive of an invention more marvelous than that which enables persons to converse with each other without regard to the space that separates them; and it is not only wonderful, but deeply interesting to the student of science, as it involves several of the most prominent physical discoveries of modern times. It is a monument of persevering and difficult study and experiment. From being a mere scientific curiosity, universally believed to be of no practical value, it has now become an important factor in the daily business and social life of this and other large cities.

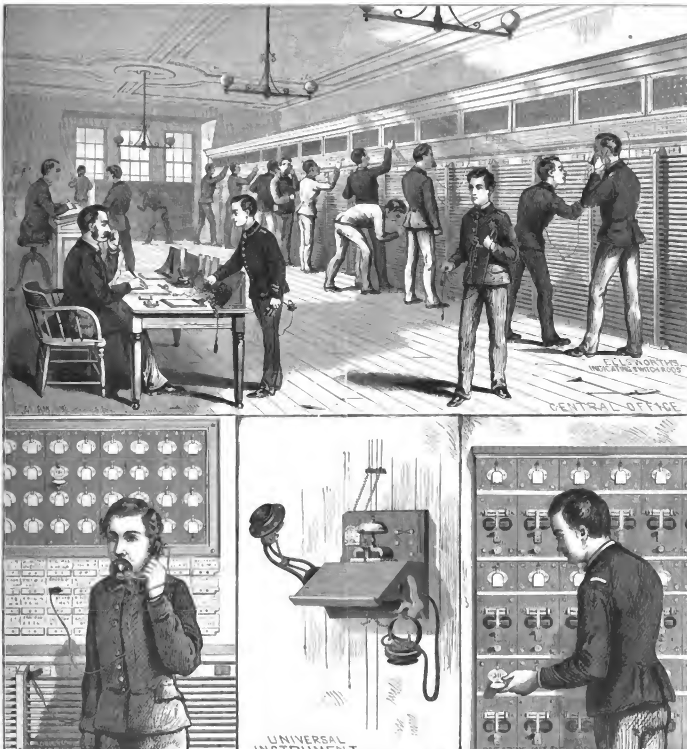
The uses to which the telephone is already applied, its future and its possible applications, will be considered in another place, the object of the present article being to afford the general reader an idea of the details of the arrangement and working of the central office system, which increases the usefulness of the telephone manyfold.

We have chosen for illustration as an example of this system in its perfected form, the Merchants' Telephone Exchange, located at 198 Broadway, and controlled by the Gold and Stock Telegraph Company of this city.

The telephone shown in the lower central figure in the accompanying engraving scarcely needs description, its construction and the details of its operation having been repeatedly described in these columns. In brief, the adjustable arm carries an Edison carbon button transmitter, connected with the primary wire of an induction coil concealed beneath the desk. A receiving telephone, which is connected with the line wire, hangs upon a switch at the opposite end of the desk. Removing and replacing the telephone operates the switch. Above the desk there is an ordinary single-stroke electric bell, and below it are two cells of Leclanché battery.

This telephone is one of many, each of which is connected by a single wire with the central office, the interior of which

[*Continued on page* 21.]



THE MERCHANTS' TELEPHONE EXCHANGE NEW YORK CITY.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, JANUARY 10, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 210,

For the Week ending January 10, 1880.

Price 10 cents. For sale by all newsdealers.

THE FUTURE OF THE TELEPHONE.

There is nothing more characteristic of the present age than the avidity with which it seizes upon and puts to practical use the discoveries of science and the infinite marvels of invention. To-day the experimental student wrests from the secret treasures of the universe a new truth, a new law, a new manifestation of force. To-morrow a countless host of printing presses spread a knowledge of the discovery to the earth's remotest bounds. Directly it is made a working factor in the world's best thought and action; in a little while some practical mind puts the harness of utility upon the new truth, and straightway the world is the richer by another useful invention. What would formerly have taken centuries to accomplish—or what the most fearless minds would scarcely have dared to dream of undertaking—is now done in a day. The invention is achieved, and finds a world predisposed to receive it with gladness, even though its adoption should necessitate many and radical changes in the whole range of national and social customs. It took the steam engine centuries to pass from the stage of science and applied to that of practical utility. The telegraph was not so many years in rising from the level of scientific experiment to that of a useful factor in the daily affairs of nations. What the telegraph accomplished in years the telephone has done in months. One year it was a scientific toy, with infinite possibilities of practical use; the next it was the basis of a system of communication the most rapidly expanding, intricate, and convenient that the world has known.

One of the most notable occurrences of our Centennial year was a little gathering of scientific men from various parts of the world to test the performance of a new scientific invention of which wonderful stories had begun to be told, especially with regard to what it was going to do. To the astonishment of all it did do marvelous things. A little disk of metal could be made to speak; still more, the operator might be miles away, and exerting power only through his vocal organs. With a couple of magnetic cups and a slender wire spoken messages were transmitted through considerable distances and delivered in tones so like those of the speaker that his personality could be detected by the sound of his voice, if it had ever been heard before. Though far from perfect, the speaking telephone was an assured fact, and a new era in social and business communication had dawned. Scores of active minds at once set to work upon the problems to which the telephone gave rise, and hundreds soon joined them. In a little while the telephone in various forms was in the hands of progressive men in every part of the world.

It was tried as a means of uniting more or less widely detached portions of business houses, as the salesroom and the manufactory, and proved a great success. As a means of social and professional communication it was equally satisfactory. The next step was to form little clusters of telephonic communicants; the wider and more varied the business callings of the members of the group and the more numerous its membership the greater was found to be the utility of the system. But it soon outgrew manageable proportions without some system of centralization. The telephonic exchange, or central office, was a natural and necessary result.

Thus a new business sprang into existence almost in a day, with no end of scientific and practical problems to solve. The machinery and working methods of the telephonic exchange are sufficiently explained and illustrated in another portion of this issue of the SCIENTIFIC AMERICAN. With the information there given one can form some idea of the present and prospective development of the system. From the little room figured, as many as six hundred lines (with an aggregate mileage of 650 miles) reach out to the offices and homes of as many subscribers in various parts of New York, Brooklyn, Jersey City, Newark, Orange, and connections are making or in immediate prospect with all other adjacent towns of any size. New lines are being added at the rate of five a day, and every new wire widens the range and increases the value of every other wire in the system. Very soon the Philadelphia exchange will be connected with that of New York, and then any subscriber in either city or its suburbs will be able to communicate directly with any subscriber in the other. Already from four to five thousand calls are made upon the exchange daily, during business hours, and the system has scarcely begun to occupy the vast field that lies open for occupation as rapidly as telephones and connecting wires can be set up.

The limits of our space forbid any attempt even to summarize the infinite range and variety of possible telephonic communication. Its scope is as wide, as limitless indeed, as is the range of communication possible between men. Any question that a business man may have occasion to ask of another, any instruction he may wish to give to a distant subordinate, any message that a boy can carry, and that may be written, falls within its province. Even at the low average of a mile for the distance between the widely separated subscribers in this city the five thousand daily communications mean five thousand miles of travel saved for somebody. And the time gained by the saving of those five thousand miles of travel means not less than a thousand hours of the most valuable portion of the day, an average of over an hour and a half daily to each subscriber. The increase of business efficiency due to such savings of time and trouble is beyond computation.

In its infancy, with the inertia of custom to overcome, the system has developed a capacity for growth that has distanced the expectation of the most sanguine, and its utility as well as its capacity for further development increases with every new wire, more especially with every new connecting link between central stations. Who, then, can have courage to predict even the immediate future of the system, or to attempt to forecast the social and commercial changes which the annihilation of time and trouble, and the doing away with the mediation of forgetful or erring servants, will bring in their train? Soon it will be the rule and not the exception for business houses, indeed for the dwellings of all well-to-do people as well, to be interlocked by means of the telephone exchange, not merely in our cities, but in all outlying regions. The result can be nothing less than a new organization of society—a state of things in which every individual, however secluded, will have at call every other individual in the community, to the saving of no end of social and business complications, of needless goings to and fro, of disappointments, delays, and a countless host of those great and little evils and annoyances which go so far under present conditions to make life laborious and unsatisfactory. The time is close at hand when the scattered members of civilized communities will be as closely united, so far as instant telephonic communication is concerned, as the various members of the body now are by the nervous system.

PROGRESS OF ARTIFICIAL ILLUMINATION.

The new year opens with unusual promise in regard to the future lighting of our homes and places of entertainment and business. Two novel and radically distinct systems of interior illumination are now before the public, both agreeing in offering strong assurances that relief from the inconvenience and imperfection of illumination by means of kerosene and gas is not very far away. Whether either or both will fulfill the promise of the day only time can tell. Both display a high degree of experimental success; but it is a different matter to meet successfully the more exacting requirements of every day use at the hands of all sorts of people.

One system is based on the division of light, however generated, the other on the division of the electric current and its conversion into light by incandescence. The first is the system experimentally developed by Messrs. Molera & Cebrian, of San Francisco, and illustrated in these pages some months ago. These gentlemen undertake to distribute radiant light, not the means of making light, such as gas or electricity. The system involves a central generator, whence light is transmitted in parallel beams through tubes to the places to be illuminated, and there thrown out by prismatic reflectors, and dispersed by proper lenses. In this way, the inventors claim to be able to disseminate the radiant energy of light with no greater loss of power than is experienced when the electric current is divided or when gas or oil is burned in separate lamps or jets. The system has been tried in San Francisco, and is said to work well. The inventors propose to light city streets and houses, as well as isolated dwellings, shops, churches, and the like, and are sanguine of success. To our mind, however, the system seems likely to exhibit its highest utility and economy in places where a single building is to be illuminated, and no facilities are offered for the economical employment of incandescent electric lights; this, of course, under the assumption that what is possible in laboratory experiments is practicable on a large scale and under the varying conditions of every day use. The sanitary and other advantages offered by this method of distributing light are such as to justify the strongest wishes for its practical success.

The other promising system of domestic illumination is that just brought forward by Mr. Edison, as described and illustrated on another page of this paper. To all appearances, Mr. Edison has got the lamp he has so long been searching for, and curiously it is not at all what he thought it would be a few weeks ago. In other words, the light is generated in a strip of carbonized paper and not in a spiral of platinum or other refractory metal. The light produced is perfect; the lamp is inexpensive and apparently durable; the economy of the general system in which it is used is tolerably clear; and all its details seem to have been worked out with Mr. Edison's usual cleverness and practical skill. The only question that remains undetermined at this writing is whether the lamp will stand the test of time. It seems almost incredible that a slender thread of carbon can withstand the intense heat of the lamp, even in a perfect vacuum, without volatilization or fracture; but the lamps are stated to have stood action of the current, both in ordinary and in extraordinary strength, long enough already to upset all reasonable opinion as to the behavior of carbon under such conditions, and there is now nothing to be done but to wait for time to determine what the ultimate issue will be. The fact that all its predecessors in the field of incandescence have sooner or later come to grief is the chief, if not the only one, compelling a suspension of judgment in the present case. We sincerely hope that no hidden flaw may discountenance the inventor's confident assurance of victory. The light is exactly what the world wants to see; and if it will only wear long enough to pay for itself, both the inventor and the public at large are to be heartily congratulated.

At this point it is proper to note the extreme simplicity of the new lamp and the lack of any startling novelty in its materials or construction. If the lamp justifies present expectation, it will have but one radical peculiarity, and that is success. And success, in a field beset with so many difficulties which men of science and practical experience have pronounced insurmountable, is the highest as well as the final proof of a great invention.

Less successful workers in the same field have been prompt to say: "Mr. Edison is mistaken: the thing cannot be done as he claims to do it." To which Mr. Edison replies: "The problem appears to be solved; time only can tell whether the solution is final."

The next objection is: "The lamp presents no new discovery; its elements are old, and everything in the system has been suggested or tried before."

To this Mr. Edison may as justly reply: "Grant that the lamp involves no discovery, that its elements are old; nevertheless, in combining old elements, I have produced a new product, an incandescent electric lamp which does what no other lamp has done; it will work and does work. Other men may have tried to do the same thing by the same means, they have failed; I have succeeded. Therefore, the lamp is fairly mine."

If Mr. Edison's success is verified by time and use, the world will frankly accord to him the credit which is his due. But whether he is successful or not, the field is still open. It is not possible that there can be but one solution to so complex a problem. Such an event never yet occurred in the history of invention. Whatever Mr. Edison's success may prove to be, it should serve as an incentive to other workers in the same field to take heart and go on to like achievements; and the greater his success the greater the assurance that others can do likewise, or possibly better.

ALEXANDER STUART.

In the death of Alexander Stuart, at his residence in Chambers street, Tuesday, Dec. 23, the city of New York lost one of its best known and respected citizens.

For more than forty years, Alexander Stuart, with his surviving brother, Robert L. Stuart, carried on the business of refining sugar on an extensive scale, under the widely and honorably known firm name of R. L. & A. Stuart. Their enormous refinery adjoined the residence of the deceased, and was within a block of the house in which the two brothers were born. Alexander Stuart had particular charge of the manufacturing part of the business, and gave his personal attention to the improvement of the machinery and to processes. He expended time and money freely, employing experts of the highest rank, such as Professor Torrey, a famous chemist in his day. By means of their skill and his own ingenuity the manufacture was carried to so high and pure a point that the firm's sugars commanded a better price in the market than those of any other manufacturer

During the last twenty years of its existence the firm employed from 250 to 300 men, and made from 35,000,000 to 40,000,000 pounds of sugar annually. In 1872, R. L. & A. Stuart retired from the refining business with ample means, and converted their enormous refinery into warehouses, the rentals of which afford a large income.

Since relinquishing the refining business the two brothers have spent their time and money in good works, contributing some years as much as a hundred thousand dollars to benevolent purposes. One of their last acts in this direction was the purchase of the magnificent Potter estate, at Princeton, New Jersey, and after refitting the mansion throughout, and making ample annual provision for its maintenance, they set the whole apart as a private residence for the President of Princeton College, Dr. McCosh.

Alexander Stuart was a man of marked character, genial in his manners, and of great benevolence of spirit, his gifts to religious and philanthropic objects being numerous and generous. By a long life of honorable enterprise and superior business capacity, he amassed a large fortune, and never failed to use it wisely.

EXCLUSIVENESS OF ENGLISH MANUFACTURERS.

One of the first things usually remarked by a foreign mechanic coming to this country is the readiness with which he obtains admission to any of our manufacturing establishments. To suppose he will be allowed, as is usual here, to freely walk about the premises and enter the different shops and departments of almost any large factory, simply as a visitor, without the intervention of some influential friend; without the necessity of feeing the "gateman," and not needing to assume any disguise, is so entirely different from his preconceived ideas, and the habits and notions in which he has been brought up, that he is generally greatly astonished. At first, too, especially if he be an Englishman, he is apt to think such liberty of inspection may be meant as an especial distinction, conferred upon him under the supposition that he is a person of more importance then he rates himself, until he becomes sufficiently well acquainted with the usages of the country to understand that such freedom is hardly counted any especial privilege.

The customs of European manufacturers generally, and of those in Great Britain particularly, are all against this way of doing business. To obtain admission to almost any of the large manufacturing establishments is generally a matter of a great deal of difficulty, to effect which it is often necessary to consult the head of the firm, present formal letters of introduction, and have passes come down from one to another through several different functionaries. It is difficult to see why this should be so marked a peculiarity in all kinds of business in England, except it be on the principle that many of the long established houses rather arrogate to themselves, from their age and financial strength, a position somewhat similar to that which the accident of birth gives to their aristocracy—thus making an "aristocracy of trade," as it were.

But true and lasting prosperity in any line of business is not developed or sustained on any such basis. From about 1840 until within the past five years, nearly every branch of industry in England had a most wonderful growth, and great fortunes were made among representative members of the middle classes. But this growth seems to have met with a severe check, and the close competition for the world's trade during the past five years has probably caused some reduction of the wealth accumulated in more prosperous times. Who shall say how much of this comparative decline in England's prestige as a manufacturing nation is due to this narrow spirit of exclusiveness, whereby inventions and improvements are necessarily limited, and the rewards therefor confined to the few? Here, every workman, from the lowest to the highest, is not only permitted to know how the work is done in every department of his business, but he is counted of little worth who does not at the same time make diligent efforts to understand all practicable ways of doing the work in his own trade and all branches related thereto. Our manufacturers, as a consequence, do not presume upon the ignorance and want of skill of their competitors, and suppose they will be able to hold in the future any advantages they may have to-day, except as they may constantly improve their productions and introduce more economical methods. They do not shut themselves up in an assumed superiority, not caring to know what others are doing, careful only to prevent their competitors from doing as well, for they know full well that, in the present progress of industry, what may be to-day's success may be comparative failure to-morrow. There is, therefore, a sharpness of competition here, and a rapidity of development which would be impossible within narrow lines and under a "dog-in-the manger policy;" and it is this spirit which has placed our manufacturers generally so far in advance of those of the rest of the world.

THE HEART AS A MACHINE.

The heart is probably the most efficient piece of physical apparatus known. From a purely mechanical point of view it is something like eight times as efficient as the best steam engine. It may be described, mechanically, as little more than a double force pump furnished with two reservoirs and two pipes of outflow; and the main problem of its action is hydro-dynamical. The left ventricle has a capacity of about three ounces; it beats 75 times a minute; and the work done in overcoming the resistance of the circulating system is equivalent to lifting its charge of blood a little short of ten feet (9·928 ft). The average weight of the heart is a little under ten ounces (9·39 oz.). The daily work of the left ventricle is, in round numbers, ninety foot-tons; adding the work of the right ventricle, the work of the entire organ is nearly one hundred and twenty-five foot-tons. The hourly work of the heart is accordingly equivalent to lifting itself twenty thousand feet an hour.

An active mountain climber can average 1,000 feet of ascent an hour, or one-twentieth the work of the heart. The prize Alp engine, "Bavaria," lifted its own weight 2,700 feet an hour, thus demonstrating only one eighth the efficiency of the heart. Four elements have to be considered in estimating the heart's work: (1) the statical pressure of the blood column equal to the animal's height, which has to be sustained; (2) the force consumed in overcoming the inertia of the blood-veins; (3) the resistance offered by the capillary vessels; (4) the friction in the heart itself. This, in a state of health, is kept at its minimum by the lubricated serous membrane of the pericardium.

THE STRUGGLES OF A SUCCESSFUL INVENTOR.

The early struggles of Mr. E. B. Bigelow, whose recent death in Boston we have already noted, afford a lesson of pluck, energy, perseverance, and final success, which ought to be very encouraging to other young inventors, when things do not go as they would like. His whole life, too, furnished another and brilliant refutation of the untruth conveyed by the ancient saying, that a rolling stone gathers no moss; everything depends on how the stone rolls.

His father was poor, and he was early set to work on a neighbor's farm at small wages. His first invention, made when he was thirteen years old, was a hand loom for weaving suspender webbing. Next he invented a machine for spinning yarn. This brought him a little money; and at sixteen he attended an academy at his own expense. Here he became interested in stenography, wrote and published the "Self-Taught Stenographer," from which he hoped to make a fortune. But the venture landed him in debt. Then he undertook the manufacture of twine, and failed again. Later he made another failure in the manufacture of cotton, which increased his indebtedness to $1,400, a large sum in those days. Then he took lessons in penmanship, becoming so skillful that he was able to support himself by teaching the art. The work did not promise any great profit, and he thought he would like to be a physician. After taking a course of classical instruction he entered his name as a medical student.

At this point, while lying one night under a Marseilles bed quilt, he conceived the idea that he could make a power loom to weave such fabrics. He dropped his studies for invention, succeeded, and entered upon a new course of effort, disappointment, more effort, and final success. A Boston house promised him money to set up his looms, but failed before he could get started. His father was also unfortunate in business and in failing health. He thought he could make something by means of a power loom for weaving coach lace, and having found that there was a good market for such products, he set to work to invent the required loom. It was another success as an invention; and, better for him, it resulted in financial success. It gave him both money and reputation. But he was cut out for still better work, and he found it in the invention of power looms for carpet weaving, the history and effect of which have already been told in these columns. He set up the first successful power loom carpet factory in the world; and subsequently passed on from looms for weaving ingrain to the greater invention of power looms for Brussels carpeting. In all he took out thirty-six United States patents, and ultimately acquired great wealth. It is said, on good authority, that by his inventions, the cost of weaving coach lace was reduced at once from twenty-two cents a yard to three cents; and the cost of weaving Brussels carpet from thirty cents to four cents.

LOW WATER ON MANUFACTURING STREAMS.

The comparatively small amount of rainfall in the latter part of the summer and through the fall months, in most of the States along the Atlantic seaboard, was felt to be a serious inconvenience in most manufacturing towns where machinery is run by water power. In many large establishments much trouble was caused, because the water in the streams on which they had been accustomed to depend for their power was for weeks too low to allow of running full time, and in some cases a total cessation of work for a considerable period was necessary. We do not now refer to the hundreds of grist mills and saw mills throughout the country, which are run by streams and creeks that were never expected to operate them steadily throughout the year. Leaving these out of the account, it is probably not too much to say that the builders and owners of scores of large manufactories, who had thought their water power practically constant, have this year been so seriously inconvenienced that the question of their future supply of water becomes one of great gravity. For they see in the prolonged stoppages they were compelled to make the past season something more than the mere effect of an unusual drought, which may not occur once in a dozen years.

Much has been said and written by those who have studied the subject carefully, about the diminished rainfall in countries and sections where the forests have been cut down, and how the character of the streams in such localities has undergone radical change, they being more subject to sudden freshets, while for the greater portion of the year the volume of water they carry is largely reduced. But such considerations as these seem to have had little weight with our manufacturers. They know that our timber lands are being used up with the most wasteful prodigality, but they have hardly given the matter a thought, in the light of its probable effect upon their business. They have seen the tanners cut down vast regions of woodland, to obtain the bark with which to make leather, much as the stock men in Texas and on the River Plate, in South America, used to slaughter cattle for the hide and tallow, the one not caring what became of the timber, as the other was indifferent to the value of the beef, and this wholesale destruction of the original forests has seemed to be a matter in which they had no interest.

The past summer has been particularly suggestive of thoughtful reflection and more careful calculation for the future, in regard to this whole question, by manufacturers who would avoid investing large amounts of capital in buildings and machinery whose value may at no distant time be greatly impaired by the falling off in the water supply on which they depend for their power. The entire section of country of which the Adirondack Mountains form the center has been greatly changed in the past few years by the wholesale cutting down of trees which has been pushed on every side. It is natural, therefore, that the water courses which are fed from this region should begin to show the effects which everywhere follow such causes, and it is not at all surprising that the manufacturing establishments in the Valley of the Mohawk should this year have had greater reason than ever before to complain of a deficiency of water. The character of the Delaware River, and the streams which fall into it, has for many years been undergoing a similar change, and now like causes have commenced to operate throughout the Valley of the Susquehanna, in Pennsylvania and New York, where are some of the largest tanning and lumbering establishments in the country. It behooves all manufacturers, therefore, who are dependent upon water power to run their machinery, to look this question squarely in the face. It is not very likely that any stop can or will be put to the destruction of our forests, so long as we have any, while individuals or firms can make money in this way; but those who are tying up their capital in enterprises where the amount and permanence of the water supply is a prime consideration should take heed, while they have time, of the changes they have every reason to look for.

Mr. B. C. DAVIS, in renewing his order for continuance of his advertisement in the SCIENTIFIC AMERICAN, writes: "The four line advertisement of my business in your paper has already brought to me orders to the amount of fifteen hundred dollars."

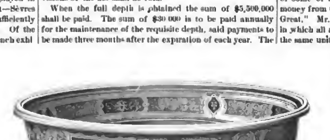
The first river steamer to adopt the electric light is the Reuben R. Springer, which left Cincinnati on her first trip to New Orleans, Dec. 17, 1879.

THE JOHNSTON HARVESTER PRIZE.

Our readers are already aware that the field trials of agricultural machinery at the Paris Exhibition of 1878 resulted in an overwhelming victory for American manufacturers. The special prizes for exceptional merit, as displayed in these practical contests, were twelve objects of art—Sèvres vases—only eleven of which were awarded, no sufficiently meritorious competitor appearing for the twelfth. Of the eleven awards seven fell to Americans, one to a French exhibitor of an American machine, two to French exhibitors of French machines, and one to an English exhibitor.

In the harvesting tests thirty-five reapers were entered, but only one award was made to that class of machines—the splendid specimen of ceramic art shown in the accompanying engraving—and that fell to the Johnston Harvester Company, of Brockport, Monroe county, N. Y., who have just received their prize.

The vase, as will be seen from our engraving, is of the shape called "tazza." It stands ten inches high, the bowl having a depth of three inches and a breadth of fourteen and a half inches across the top. Outside the prevailing colors are blue and gold; within are panels of scroll work, tritons, and trefoils, with circular bands in gold. In the center is a raised medallion representing the city of Paris—a female head with a mural crown. Around the medallion are scrolls, rosettes, fruits, wheat ears, and other agricultural symbols. Around the body of the vase is a wreath of fruits, flowers, and grain, with a spiral pink band bearing the inscription, "Exposition Universelle, Paris, 1878," and medallions with agricultural symbols. The pillar is in blue and gold, with bands, frets, and festoons; and the foot has a circular band inclosing quatrefoils on a green ground, broken by four panels, severally containing the words "Sèvres," "Paris," "Exposition," "1878." The intrinsic value of the vase is placed at one thousand francs; but that is a small matter compared with its actual value as a testimonial to the practical superiority and exceptional merit of the reaper which earned it in a field contested by so many able rivals.



SEVRES VASE—SPECIAL PRIZE, PARIS EXHIBITION.

Jacobsen's Method for Photo Printing.

Prepare a carbon picture in the usual manner upon a sheet of glass, and surround the picture with a wooden frame which exactly fits round the sheet of glass. Then pour into the frame a mixture (not too hot) of one part of gelatine, one part of gum arabic, and two parts of glycerine. When the mass has stiffened in the frame, carefully remove the latter from the former with a knife, and with equal care invert the gelatine plate, with which the carbon picture will now be incorporated. To ink the picture use a ground glass roller, and the inking process proceeds most favorably when done upon a smooth, elastic support like that used for rolling letter press forms. The printing ink, which must be very thick, is previously dissolved in oil of turpentine or in benzole, and some of this solution, without the addition of varnish, is poured upon the plate and distributed over it by the glass roller.

The plate being inked, a sheet of uncoagulated albumenized paper corresponding in size to the picture is laid upon it, and an India-rubber roller is passed softly across the paper, which is then lifted off the plate. The albumenized paper, which absorbs moisture readily, should not be allowed to lie too long upon the plate for fear of the albumen dissolving off and dirtying the plate. It is not necessary to damp the plate with water, as it possesses sufficient moisture to allow of a dozen impressions being taken. Of course this moisture is exhausted at last, but the plate is sufficiently hygroscopic to absorb enough moisture from the atmosphere in the course of a few hours to allow of printing being resumed.

While in other lichtdruck processes the image is sunk into the plate and the ink has to sink into the shadows, this method has the advantage of furnishing a relief which facilitates printing. By this process, also, round objects, such as bottles and vases, can be printed—possibly even with colors, which could be burnt in."

SEVRES VASE—TOP VIEW.

The Entrance to New York Harbor.

A bill has been introduced in the House of Representatives at Washington to create a permanently deep, wide, and straight channel through Sandy Hook bar to the port of New York. The bill provides for the construction of such works on the seaward or outward side of Sandy Hook bar as may be necessary to effect permanently and beneficially the part known as the Swash channel "and the fourteen foot channel." The works are not to impede navigation, and they are to begin not later than one year from the passage of the act. The works are to be pushed so as to increase the depth six inches annually until the full depth of thirty one feet six inches shall be obtained, otherwise the provisions of the act shall be void.

When the full depth is obtained the sum of $5,500,000 shall be paid. The sum of $30 000 is to be paid annually for the maintenance of the requisite depth, said payments to be made three months after the expiration of each year. The terms and conditions of the various payments are as follows: $500,000 to be paid when a depth of 27 feet 6 inches and a mean width of 200 feet are obtained; $500,000 when a depth of 28 feet is obtained; $500,000 when a depth of 28 feet 6 inches and a width of 300 feet are obtained; $500,000 when a depth of 29 feet is obtained, $625,000 when a depth of 29 feet 6 inches is obtained and a width of 400 feet; $625,000 when a depth of 30 feet is obtained; $625,000 when a depth of 30 feet 6 inches and a width of 450 feet are obtained; $625,000 when a depth of 31 feet is obtained; the final payment in full of $1,000,000 when the full depth of 31 feet 6 inches and a width of 500 feet are obtained.

The persons engaged in the work are not to shut off the flow of water through any of the channels over the bar by damming up, by the erection of jetties, or by impeding or controlling in any way the natural flow of the water, nor resort to dredging, blocking, or any stirring-up process, for the purpose of more quickly achieving the required depths, but shall make the channel permanently deep.

William A. Drown.

Mr. William A. Drown, one of the largest umbrella manufactures in the world, died in Philadelphia, Saturday, December 18, in the seventieth year of his age. He was born in Portsmouth, N. H.

Weight Applied to Money.

At a recent meeting of the Bankers' Institute, London, Mr. Barclay V. Head, assistant keeper of coins at the British Museum, read a paper "On the origin and transmission of some of the principal systems of weight as applied to money from the earliest times to the age of Alexander the Great." Mr. Head stated that a theoretically perfect system in which all measures and weights were referable to one and the same unit had been attempted (if never quite attained) twice only in the whole history of mankind, once by the Babylonians in their sexagesimal system, and once again, after a period of 3,000 years, by the French in their decimal system. Numismatists were generally agreed that the Lydians, about 700 B. C., were the inventors of the art of coining, and that the earliest coins were composed of electrum—a natural compound of gold and silver found in the washings of the river Pactolus. This coinage lasted about a century and a half, and was then superseded by a bi-metallic currency of gold and silver, instituted by Crœsus. Henceforth bi-metallism in the currency became the rule in Asia down to the age of Alexander, being based upon the constant fixed ratio of 1 to 13⅓ between gold and silver. The currency of European Greece, Mr. Head believed to have been generally mono-metallic, based upon silver, not upon gold. This continued to the time of Philip of Macedon, in whose reign the rich gold mines of Philippi were discovered, and gold for the first time became abundant in Europe. Philip thereupon reorganized his currency, introducing bi-metallism, with the view of artificially keeping up the price of gold as compared with that of silver. This device was futile, and Alexander the Great returned to the ancient system of mono-metallism, based upon silver, though he coined gold. From this time the gold coinage was regarded merely as bullion, an attempt being made to regulate the value of one metal by the other. Mono-metallism henceforth became universal, even in Asia. This change from a double to a single standard in Asia was facilitated, in Mr. Head's opinion, by the sudden depreciation of gold (for the first time in history) consequent upon the dispersion by Alexander of the long-hoarded treasures of the Kings of Persia.

The "Kohinoor" Pearl.

Some months ago the pearl fisheries of the Miami River, Ohio, were described at considerable length in this paper. The past season has been signalized by the discovery of an agatized pearl, weighing forty-six and a half grains. The groundwork is beautifully agatized with the pearly iridescence shining through. It is the only pearl of the kind in pearl history, a history which dates back at least two thousand years, for the Ceylon fishery has been known for quite that length of time. Being the first of its kind, its value cannot be estimated. It is singular, too, that it was found embedded in the flesh of the mussel; all others taken from this river were found between the flesh and the shell, or embedded in the shell.

The prosecution of this industry is due largely to Mr. Israel Harris, a banker of Waynesville, Ohio, who has already a collection of over a thousand Miami pearls of all sizes and values, some of them of odd and irregular forms. Some resemble human hands; one is a small shell to which a coating of pearl has been added. His latest important acquisition, the agatized pearl, he calls the "Kohinoor."

A Large Consignment of Silkworms' Eggs.

A consignment of silkworms' eggs, filling six freight cars, and valued at $850,000, arrived in this city December 19, from Yokohama, by way of San Francisco. The eggs were from Japanese nurseries, and had been collected and consigned to silk growers in France and Italy by their agents at Yokohama. The route followed was chosen in preference to that by the Indian Ocean and the Suez Canal owing to the lower temperature. Great care has always been necessary by the Indian Ocean route, and, even when that was exercised, consignments were often spoiled by the high temperature in doubling the southern points of Hindostan. The increased number of transfers slightly injures the eggs, but the aggregate damage is considerably less by way of New York than by way of the Suez Canal. The eggs are packed in cases measuring three feet in length by about one foot in width and depth. Each case contains about 600,000 eggs, gummed to strips of cardboard separated by layers of tissue paper. From twenty to twenty-five strips are placed in each case, each strip containing from 30,000 to 35,000 eggs. With this simple packing and with due precautions against moisture and high temperature, these delicate structures are transported three fourths of the

distance round the earth in perfect safety, provided always that a moderately cold fresh air is given free access to the quarters in which they are stored. Heat, it is stated, produces an immediate effect upon the development of the larvæ, thus rendering it impossible to deliver them in good condition for growing.

The partial failure of the European silk crop the past year has made an unusual demand for Japanese eggs, and other large consignments are anticipated.

EDISON'S LATEST ELECTRIC LIGHT.

It is somewhat strange that carbon, the only substance of any value for the contact surfaces of telephone transmitters, should also prove to be the only substance suited to the light-giving portion of electric lamps. The production of an electric light by the incandescence of platinum is, for the present at least, laid aside by Mr. Edison for the more promising and more satisfactory carbon. Not the carbon so familiarly known in connection with electric lighting, but a new article having different qualities, and remarkable both for the simplicity of the process by which it is made, and its efficiency as a light-giving body when raised to incandescence by the passage of an electrical current.

The discovery of this new form of carbon was partly accidental, but more the result of Mr. Edison's faculty of seizing upon the slightest suggestion and following it as long as it invites investigation.

The first carbon prepared by Mr. Edison for this purpose was formed of a thread enveloped in a paste made of lampblack and tar, and carbonized at a high temperature. This carbon thread, although not remarkably successful, gave sufficient encouragement to warrant further investigation in the same direction. After the trial of a number of other substances it was determined that the best of all was paper, simple plain paper, without lampblack or other applications. In making these carbons the quality of cardboard or paper known as Bristol-board is used.

The completed carbon is shown full size in Fig. 1; the blank from which it is made is shown full size in Fig. 2. It will be observed, by comparing Fig. 1 with Fig. 2, that the paper shrinks enormously during the process of carbonization.

The manufacture of these little carbon "horseshoes," as they are called at Mr. Edison's laboratory, is very simple. The paper blanks, after being cut by dies in the form shown in Fig. 2, are subjected to heat sufficiently strong to drive off by destructive distillation all volatile matters. The paper horseshoes thus prepared are placed with alternate layers of tissue paper in shallow iron boxes, and weighted down with thin plates of ordinary carbon. These boxes are closed by tight-fitting covers, and placed in a muffle, when they are raised to a high temperature, which is maintained for a considerable time. The only index of the completion of the process is the crackling of the oxide formed on the exterior of the iron boxes. After cooling the carbons are removed from the iron boxes and placed between the jaws of small platinum vises, *a a*, which are supported on the platinum wires blown in the glass base and forming the electrodes. A portion of the glass base and the carbon and its supports are inclosed by a glass bulb, from which the air is so completely exhausted by means of a Sprengel pump that only a millionth part of the original volume remains.

Mr. Edison has improved the Sprengel pump so that high vacua may be produced in 25 minutes instead of the 45 hours consumed in the operation by some of our physicists. The vacuum is so nearly perfect that none of the tests to which the lamps have been subjected so far, indicate the presence of the slightest trace of air.

For making his Sprengel pumps and other vacuum apparatus, Mr. Edison fortunately secured the services of an expert glass worker, who was formerly engaged in the laboratory of the famous Geissler, of Bohn.

The electrical resistance of the slender carbon horseshoe is 100 ohms, and, while the lamp shown in Fig. 3 is intended to afford a light equivalent to a single four foot gas jet, it may be forced to give a light equal to that of 8 or 10 such jets. We saw a single lamp of this kind giving a light that enabled us to read the SCIENTIFIC AMERICAN 100 feet away. This was certainly an extraordinary performance for a piece of carbon having a surface no larger than that shown in Fig. 1.

One of the most remarkable experiments connected with the exhibition of these lamps was that of connecting one of them with the main electrodes by means of a yard of No. 36 copper wire, no larger than a horse hair. The light was maintained without heating this very small conductor. Of course a wire of this size is too small to use in regular practice, but it strikingly exhibits the advantage of having a light-giving body of high resistance.

The carbon is very tough and flexible, and not liable to be broken or injured by jars. We saw one of the carbon horseshoes nearly straightened before it broke. The carbon not only withstands rough mechanical usage; it is also proof against injury by the sudden turning on and off of the electric current. One of these carbons has been subjected to the severe test of applying and removing the electric current a number of times equivalent to 36 years of actual daily use, and yet the carbon is not in the least impaired.

The horseshoe form of the carbon has a great advantage over the straight pencil or the voltaic arc, the light being more diffused, and therefore softer and mellower, casting no sharp black shadows, nor giving such an intense light as to be painful to the eyes. The light resembles that of a gas jet excepting in the matter of steadiness, the electric light being perfectly uniform and steady.

The lamps are connected in multiple arc, *i. e.*, the two wires leading from the electrical generator run parallel to each other, and the lamps are placed between and connected with each wire. As Mr. Edison has his circuit arranged it does not make the slightest difference, so far as the lamps are concerned, whether one or fifty of them are in use; it does make a difference, however, in the power consumed at the generator. The regulation of the current is reduced to the simple matter of varying the intensity of the magnetic field in which the armature of the generator revolves.

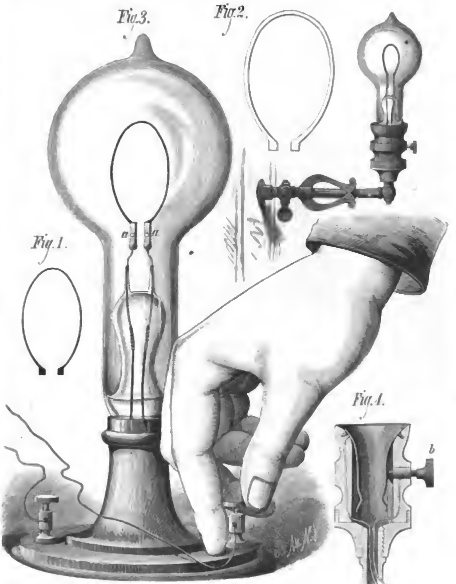
The entire lighting apparatus of a house, store, office, or factory, consists in the lamps and a few wires. There are no regulators, no complicated switches, no resistance coils to replace the lamps when the latter are not in use. The lamp, in its present form, is as simple as a candle, and, candle-like, it may be taken from its socket and replaced. This may be done while the current is on.

The construction of the socket which supports the lamp will be understood by reference to Fig. 4.

The lamp has attached to its electrodes slips of copper, which are bent upward against the sides of the glass, and touch two springs at opposite sides of the socket. One of these springs is connected with one of the electrical conductors; the other spring merely touches the copper strip, and does not form a part of the electrical conductor until it is touched by the thumb screw, *b*, this screw being connected with the second electrical conducting wire. To start the light it is only necessary to turn the screw, *b*, until it touches the spring. To stop the light the screw is turned in the reverse direction. From this it will be seen that the electric lamp is managed easier than a gas burner, as it requires neither lighting nor regulating.

On the evening of our visit to Mr. Edison's laboratory, he had more than thirty of these simple little lamps in operation, the current being supplied from one of his machines. Each lamp gives a clear, soft light equal to that of a four foot gas burner. These lamps had already been in continued operation for more than 48 hours, and they had seen altogether as much use as they would in 30 days of ordinary domestic or business service. The light certainly leaves nothing to be desired so far as its efficiency is concerned, and we are assured by Mr. Edison that, on the score of cheapness or economy, his system of illumination is far in advance of any other, not excepting gas at the cheapest rates. It seems that the subject of general electric lighting is now reduced to a mere question of time. If Mr. Edison's lamps withstand the test of time, he has unquestionably solved the vexed question and has produced what the world has long waited for; that is, an economical and practical system of electric lighting adapted to the wants of the masses.

The details given above were obtained by us direct from Mr. Edison and his assistants during a recent visit to the Menlo Park laboratory.



EDISON'S LATEST ELECTRIC LAMP.

Nitrolin.

A new explosive compound, known as nitrolin, is compounded as follows: From 5 to 20 parts of sugar or sirup are mixed with from 25 to 30 parts of nitric acid in a wooden or gutta percha vessel. Of this compound 35 to 30 parts are mixed with 13 to 35 parts of nitrate of potassa and from 13 to 15 parts of cellulose.—*Chem. Centralblatt.*

MISCELLANEOUS INVENTIONS.

Mr. David Booker, of Edom, Texas, has patented an improved implement for trimming and cutting and laying down hedges. It consists in a peculiar combination of knives and levers.

Mr. George C. Phillips, of Silver City, Nev., has invented a steam piston packing, which consists in making the suitable packing rings with their adjoining faces inclined in opposite directions, so that the pressure of the gland will compress and expand the packing rings alternately to pack the piston and stuffing box, such rings being used in connection with a conical sleeve of novel construction, which sits within the stuffing box and around the piston rod.

Mr. George H. Bosshardt, of Ida Grove, Iowa, has patented an improved attachment for the damper rods of stove pipes, furnace pipes, and other pipes and flues, which is so constructed as to hold the damper rod and damper in any position in which they may be placed, and at the same time indicate the position.

Mr. Benjamin B. Oppenheimer, of Trenton, Tenn., has patented an improved fire escape or safety device, by which it is stated a person may safely jump out of the window of a burning building from any height, and land without injury on the ground. It consists of a parachute attached to the upper part of the body, in combination with overshoes having elastic bottom pads of suitable thickness to take up the concussion with the ground.

An improved shirt has been patented by Mr. Richard O. Davies, of Newark, N. J. The object of the invention is to furnish shirts having fastening devices permanently connected with their neck bands and cuffs. It consists in the combination with the neck band and cuffs of shirts, of tabs having buttons fastened to their free ends, so that the buttons may be used for securing the neck bands and cuffs when required.

Mr. Truman S. Richards, of Woodman, Wis., has patented a buckle for use on harness, and for other purposes, to which the strap may be attached readily, without stitching, which will hold firmly, and permit ready disconnection of the strap. It consists in a buckle fitted with a wedge-acting slide or clamp fitted to move lengthwise of the buckle and clamping the strap, and the slide is also formed with serrations that act to hold the strap more securely.

Mr. Russell B. Griffin, of Osage Mission, Kan., has invented an improved butter package that perfectly protects the butter from weather, dust, etc. It consists in the arrangement of a butter package having its sides beveled or curved, and lined with cotton or linen cloth overlapping on top, and having two straps of metal, wood, or cardboard, to strengthen it.

Mr. Joseph McMullin, of Casey P. O., Iowa, has invented an improved implement for drawing dried fruits, sugar, and other materials from barrels. It consists in two bars formed with claw-shaped ends and pivoted together crosswise. The straight portions of the bars serve as handles, whereby the claw ends may be spread and then brought together, to pierce and separate the material. The points of the claws are of peculiar shape, by which they clear themselves when spread for dropping the fruit.

Mr. James C. Bowen, of Mandarin, Fla., has patented an improved refrigerator for shipping strawberries and other perishable fruits, which is so constructed that pieces of ice cannot be jarred out of the ice box to fall upon the fruit, and the waste pipe is arranged so that it cannot become clogged.

Mr. Louis Emile Jannin, of Paris, France, has patented an improved composition for stereotype moulds made from a cement composed of protoxide of lead and glycerine.

Mr. Levi Talcott, of Minetto, N. Y., has patented an improvement in fastenings for end gates of wagons. It consists of bolts provided with V shaped right-angular heads, held in a horizontal position, so as to be shot out from the ends of the gate and pass through mortises in the vehicle sides, where they are turned up at right angles to the mortise, thus fastening the sides and end gate together, and by the action of the heads the sides are drawn closely against the ends of the gate.

Messrs. George Wadsworth, of Boston, Mass., and Joseph P. Smith, of New York city, have patented an improved brush. This is an improvement in the class of bristle brushes used for painting, whitewashing, etc.; it consists in an arrangement whereby the bristles are firmly secured to the stock or head; also in providing the stock with a dovetailed core, along which the butts of the bristles are laid and secured by wooden strips on each side held under a metal ferrule securely fastened to the core outside of the bristles.

An improvement in violins has been patented by Mr. Carl Kreutzer, of New York city. This invention relates to the construction of violin bodies, the object being to improve the tone of the instruments and render them lighter, more ornamental, and less costly. The inventor constructs the back, belly, and sides from sheets of veneer or thin wood glued together with the grain crossing. These compound veneer sheets are cut out and stamped up to shape, and the body then formed by gluing the parts together. The ornamental edge is formed of a separate piece that consists of alternate layers of light colored wood and ebony, and is worked to a beaded form after attachment.

Mr. James T. Brown, of Saranac, Mich., has patented an improved fire-pot for soldering iron heaters, which consists of a cylindrical metallic vessel or combustion chamber with a perforated bottom and side openings fixed centrally within a larger cylinder that is provided with a movable cover and smoke pipe; and it further consists of a circular shallow vessel, called a "generator," that is set in the top of the interior cylinder, and supplied with oil or gasoline, or other hydrocarbon, through a pipe connecting with an elevated reservoir.

Horse Car Heaters.

New Haven horse cars are now successfully heated by a patent stove suspended under the middle of the car floor. The invention is a box 6 inches wide and high and 12 inches in depth or length, surrounded by a casing, into which air is introduced by perforations, other perforations leading to a reservoir of air under the seat, and the front of the reservoir opening into the car by register holes. The smoke escapes by a pipe passing through a similar reservoir or case, the pipe extending above the car roof at the driver's platform. The fuel is anthracite, giving off no visible smoke. Two cars so fitted, running 16 hours, burned but one bucket of coal.

A NEW FILTER.

The accompanying engraving represents an improved water-drawing and filtering apparatus recently patented by Mr. John B. Lindsay, of 117 West Third street, Davenport, Iowa. The detail view, which is partly in section, shows the internal construction of the filter. The large cylinder containing the filtering material has in one end an airtight chamber which buoys up the filter and keeps it at or near the surface of the water. Silicious sand, the filtering medium, is contained in the perforated portion of the cylinder, which is screwed on the end of the suction pipe of the pump. The portion of the pipe that projects into the cylinder is perforated and covered with wire gauze to prevent the entrance of sand to the suction pipe.

The pipe has a swivel joint which allows the filter to accommodate itself to the level of the water in the cistern or reservoir.

LINDSAY'S FLOATING FILTER.

The inventor of this filter claims that water taken from the surface is purer and better than that taken from the lower portion of the well or cistern; and he also states that there is a peculiar advantage in drawing the water through the filter rather than to allow it to pass through by its own gravity.

As soon as the pumping is stopped whatever impurities may have collected on the exterior of the filter drop off, so that the filter is really self-cleaning.

Tracing and Retouching Desk.

In the *Photographisches Archiv* Herr J. Terhelf gives directions for making a cheap retouching desk suitable for employing with artificial light during the long winter evenings. The requirements are a common, low petroleum lamp without a stand, having a round burner and a pyramidal pasteboard box. The latter is made by cutting four pieces of strong pasteboard into pyramidal shape, the bottom and sides each being about 12 inches in length and the top 3 inches. These four pieces of pasteboard are now fastened together so as to form a four sided pyramid, open at both top and bottom. The outside of the box is then covered with dark paper. In one side of the box, at a convenient height, cut a hole to permit the passage of the light; at the inner side of the hole place a piece of ground glass slightly tinted with Berlin blue, and on the outside, just at the bottom of the hole, paste on a strip of thick cardboard upon which to rest the negative. The desk being now ready place the lamp inside it and set to work. On account of its cheapness Herr Terhelf speaks only of making this retouching desk of pasteboard; but, if found convenient, one would think a less temporary one might be made in wood on the same plan, which could still be easily moved from place to place, or even, if provided with hinges, fold up into very small compass.

The Man who Forgot his Identity.

Our readers will remember the interesting case of forgotten identity reported not long since from St. Clairsville, Ohio. The publicity given by that report has been the means of discovering the antecedents of the unfortunate gentleman, who turns out to be Royal Cowles, formerly a jeweler of Cleveland, Ohio. A paper of that city says it is now definitely ascertained that when Mr. Cowles left Cleveland he was suffering under a terrible mental strain, which clouded his intellect. He had wandered aimlessly into the southeastern part of Ohio, when his condition attracted attention, and he was placed in a hospital at St. Clairsville. He has been fully identified by his friends; but whether the gap in his memory has been filled is not reported.

Correspondence.

The Utilization of Sawdust.

To the Editor of the Scientific American:

In your issue of December 13, I noticed an article under the title, "Invention wanted to utilize sawdust."

It is here a well known fact that sawdust, by itself alone, has been successfully used for producing potatoes. For this purpose it is only necessary to lay on the open ground, in rows of two to three feet apart, the potatoes that are to be planted, and cover the same with a bed of sawdust (say) from six to twelve inches thick. If the season is in the least favorable it will be astonishing how this method of culture will prove satisfactory. Another method, which I think preferable, is to prepare the soil by plowing and pulverizing, to open furrows two to three feet apart, to put in said furrows a four inch layer of sawdust, on this lay the potatoes that are to be planted, covering them with another layer of sawdust, and over this a layer of the soil.

Sawdust can be used with advantage about fruit trees. Mixed with the soil it enriches the latter, and placed on its surface it maintains moisture and prevents the growth of many troublesome weeds. In vegetable gardens it does also very well, especially around cabbage plants.

Sawdust will rot as soon as any other vegetable matter, according to the species of wood from which it originates. Mixed with the soil it keeps the latter more mellow. An application of sawdust, say of three cart loads to the acre, during four years, over the poorest land and plowing, and cultivating same each year, will render it the most fertile.

Abbeville, La. A. D MARTIN.

Traction Engines in the Sandwich Islands.

To the Editor of the Scientific American:

I am manager of the Kohala Sugar Company, Kohala, Sandwich Islands, and in your issue of February 15, 1879, you gave a sketch of our traction engine. I have taken the SCIENTIFIC AMERICAN for some years, and some time ago I noticed a leading article, in which you said in time the traction engine would be the feeders of all the main lines for farmers getting their produce to markets. I think you were right, and it may be interesting to you to know that the engine is a success with us. We have two more nearly due from England, and I expect during next year (1880) to do away with cattle altogether in hauling cane to mill, and intend, if everything goes right, to see in time what we can do at steam plowing. With our 10 H. P. engine we have been hauling to mill from 75 to 90 tons weight of cane per day from a distance of one mile on an average (two miles there and back), and taking the place of 80 head of cattle. We use on an average for this amount of work 800 lb. of common Sydney (Australia) coal per day. I got from New York 50 tons of Pennsylvania anthracite coal, but it would not do. It was too slow, and would not raise steam when we were going with a full load, which soft coal will do, and which you must be prepared to do on coming to a hill or up grade. In trying the engine, we brought 10 tons of cane (exclusive of weight of wagons) up a grade, rise 1 foot to 11 feet 3 inches, with 100 lb. steam, and in a pinch you can safely put on 150 lb. steam. I had a man from the shop in England come out to show us how to run her, and teach any one I wanted, and he will remain till the new engines arrive. We thought it best to go to this expense so as to be sure we should know what the engines could do, and we are satisfied that the expense of getting him out, and returning him, is not lost to us.

The new engines are of the latest patent, 8 H. P driving wheels 7 feet diameter, instead of 6 feet, and have a drum and 100 yards of wire rope attached, so that if the wagons are loaded in a boggy place, we block the wheels of the engine and run the rope out to the wagons and fetch them up to the engine by turning the drum. G. C. W.

What is a Cold?

On a less authority than the London *Lancet* would the theory be credited that the resolve of a person not to take cold is ample protection against having one. "It is startling to discover," says the *Lancet*, "how little we know about the commoner forms of disease. For example, a 'cold;' what is is it? How is it produced, and in what does it consist? It is easy to say a cold is a chill. A chill of what part of the organism? We know by daily experience that the body as a whole or any of its parts may be reduced to a considerably lower temperature than will suffice to give a man a cold if the so-called chill be inflicted upon the surface suddenly. Is it, then, the suddenness of a reduction of temperature that causes the cold? It would be strange if it were so, because few of the most susceptible of mortals would take cold from simply handling a piece of cold metal or accidental contact with ice. The truth would seem to be that what we call cold taking is the result of a sufficient impression of cold to reduce the vital energy of nerve centers presiding over the functions in special organs. If this be the fact, it is easy to see why nature has provided the stimulus of a strong fit of sneezing to rouse the dormant centers and enable them at once to resume work and avoid evil consequences. This explains why the worst effects of cold do not, as a rule, follow upon a 'chill' which excites much

sneezing. Shivering is a less effective convulsion to restore the paralyzed nervous energy, but in a lower degree it may answer the same purpose. The shivering that results from the effect of a poison on the nervous centers is a totally different matter. We speak only of the quick muscular agitation and teeth chattering which occur whenever the body is exposed to cold and evil results do not ensue. It follows from what we have said that the natural indication to ward off the effects of a chill is to restore the vital energy of the nerve centers, and there is no more potent influence by which to attain this object than a strong and sustained effort of the will. The man who resolves not to take cold seldom does."

THE TELEPHONE CENTRAL OFFICE SYSTEM.

[*Continued from first page.*]

is represented in the larger view in the engraving. Each person having the use of a telephone connected with the central office is called a subscriber, and his wire entering the office is connected with a small switch—a jack knife switch; just below his name, and by this switch an electrical communication between the line and one of the annunciators above the switch is established or broken.

The arrangement of a telephone line in its normal condition is as follows: One wire from the subscriber's local battery is grounded; the other connects with the push button seen at the side of the desk. When this button is pressed the current from the local battery passes through the line wire, through the switch at the central office, through the magnet of the annunciator to the ground. The effect of the passage of the current through the annunciator is to release the little cover concealing the number of the subscriber's wire, permitting it to drop and expose the number. On seeing the number, the switchman connects his portable telephone with the subscriber's line, by inserting the plug at the end of the flexible telephone cord in the jack-knife switch. This operation not only connects the switchman with the line, but it also breaks the connection between the subscriber's line and the annunciator. The switchman's telephone being already connected with a battery and induction coil, and in condition to talk over the subscriber's line, he says to the subscriber, whom we will call A: "Well, A; what will you have?" A then says: "Connect me with B (say) at 25 Wall street."

The switchman then connects A's jack-knife switch with one of the long horizontal bars seen below; switches and turns the bar slightly, to indicate that it is occupied. He then goes to B's jack knife switch; inserts one end of a flexible cord in the switch, and taps on a long brass strip connected with the central office battery, thus sending electrical impulses through B's line wire, ringing B's bell, when B removes his receiving telephone from its switch, and listens while the switchman connects B's jack-knife switch with the same horizontal rod that is connected with A. He then removes A's connection from the rod, and tells A "All right; go ahead," when the conversation between A and B proceeds. It takes only seconds to do what has required minutes to describe.

The boys attending the switches become expert and rarely make mistakes, although it is difficult to see how anything could be done correctly amid the din and clamor of twenty or thirty strong voices crying, "Hello! hel-l-o, A!" "Hello, B!" "What will you have?" "Who?" "Which?" "What?" "A-l-l right," and so on. It seems anything but orderly and systematic; but, nevertheless, it is the very embodiment of order and system. There are no less than six thousand calls per day; yet there is no delay, no mistakes, no trouble, save from the occasional breaking of a wire or the crossing and interference of one wire with another.

An idea of the activity of a telephone central office may be obtained from the larger view. The actual condition of things is far from being exaggerated.

It doubtless will be asked, How is it known at the central office when A and B have finished talking? The clearing out relays shown in one of the lower views, and at the farther end of the office in the upper view, indicate this. These relays, which are of comparatively high resistance, are each arranged to work a local circuit in which there is an annunciator representing one of the switch rods.

Each horizontal switch rod is connected with one of the relays, and all of the relays are grounded. Now A, having begun the conversation through the telephone, must indicate when it is ended; therefore, upon hanging up his receiving telephone, he pushes the button four or five times, working the relay, and consequently the annunciator connected with it, indicating that whatever is connected with the horizontal switch rod whose number corresponds with that of the annunciator, may be removed, and the switch rod may be used for C and D, or any one else.

One desk, seen at the right of the larger engraving, is the chief operator's desk, and the line-men, whose business it is to rectify troubles, get their orders at this desk.

There are upwards of 600 wires entering this office alone, and it requires over a thousand cells of battery to work this maze of wires.

Persons desiring to avail themselves of this means of communication subscribe to certain conditions, which require, among other things, the payment of a monthly rental, and the observance of the rules of the company. Men are then sent from the central office to place the telephone and battery, and to run from the subscriber's telephone to the central office a wire, supporting it at intervals by poles and fixtures as in the case of telegraph lines. The line and the instrument are kept in order by the company. Any imperfection in the action of either reported to the chief operator's desk at the central office receives immediate attention, men being sent out at once to find and remedy the trouble.

An alphabetically arranged list of subscribers is furnished with each telephone, and as new subscriptions are made, supplementary lists are furnished to all subscribers.

Among the recent improvements in telephone exchanges is the portable switchman's telephone, which is clearly shown in the lower left-hand view in the engraving, and the switch rods, shown in the same view, and also in the larger one. The latter are the invention of Mr. T. G. Ellsworth, the manager of the central office. They certainly save a great amount of labor, and prevent confusion and trouble.

The telephone, like many other modern inventions, needs to be used to be appreciated. It is wonderful enough that we are enabled to talk to persons in all parts of this great city, but when we can talk without difficulty with persons in neighboring cities, it becomes even more wonderful and interesting. The lines which connect New York with Newark run under the North River. Those that connect New York and Brooklyn are suspended from the East River bridge towers. The wires may run underground, under water, or high in air.

The large and rapidly-increasing number of telephone lines indicate the growing popularity of this means of communication, and we confidently expect at no distant day to see it almost universally adopted for business and even domestic purposes. Already the wires extend in every possible direction from the central office, and fairly darken the sky in some localities. The Gold and Stock Telegraph Company have in this city three exchanges similar to the one we have described, connected with each other, and, with the central office systems, several of the adjoining cities. Jersey City, Newark, and Orange, N. J., and Brooklyn, N. Y., are so connected. Yonkers, and, in fact, all of the other important cities surrounding New York, will undoubtedly be telephonically connected with the metropolis before the beginning of another year. We understand New York and Philadelphia are soon to be connected in this way. The convenience of such means of communication is thoroughly appreciated by business men, whose operations are confined to a few hours, and whose time is valuable. The SCIENTIFIC AMERICAN has constant proof of the utility of this invention, as there is scarcely an hour in the day that the telephone in the office is not used in communicating with some one, either in this or one of the adjacent cities.

ON THE DEPHOSPHORIZATION OF IRON.

BY PROF. MAURICE REIL.

Science has of late years made fast strides, and one scientific fact after the other has been forced to yield the point which it is the business of our utilitarian age to force from facts. In the chemical metallurgy lately the perfection of the process for the dephosphorization of iron has caused quite a sensation, and has set scientists to work for further investigation. Not long ago the convenient and economical use of our most reliable metal—iron—was hampered by the facility with which it rusted and decayed. Once attacked by rust, the rust point was a center from which proceeded further corrosion with fatal rapidity; but also in this instance, true to the exacting spirit of the age, nature has been made to yield up her secret, and iron is to wear in future a protecting coat of oxide of iron, to the perfection of which centuries testify.

In the new dephosphorization processes of Krupp and Bell, and of Thomas and Gilchrist, a problem has been solved which has baffled the scientific world for years. And it must be admitted as a great invention, the importance of which it is scarcely possible to exaggerate. In the light of the past history of inventions, it is not surprising to find that the development of this important process is not the work and thought of one man. The same end certainly has been accomplished, independently, but by different means. The importance of the invention lies in the fact that, while up to the present districts which had only at their disposal iron ore of a phosphoric nature exclusively, were not able to produce any forged iron or steel, will now be able by means of this process to work iron up to any imaginable form or shape or manufacture steel. This process will certainly also revolutionize a complete alteration in the relative iron production for the future.

As remarked above, both processes are alike in principle but different in execution. The process of Krupp and Bell is divided into two stages. First, elimination of the phosphor (100 parts of iron melted in a cupola oven to 15 of oxide of iron, or 25 per cent consumption of ore if worked in a Siemens-Martin furnace) in a rotating oven attained a reduction of the phosphor from 0·6 to 1·2 up to 0·13 to 0·3, therefore a refining, and afterward conversion of the refined iron in the converter. Silicium iron must be added to the product, as this is taken away in the first stage.

In the Thomas and Gilchrist process both stages are united in the converter, as by means of a basic lining and basic flux the elimination of the phosphor is produced, as shown further on.

Taking particularly this process the last experiments that have lately taken place in an eight ton converter fully demonstrate the complete success of the invention, which is as follows:

The converter used for the experiment was lined with basic bricks, of the following chemical composition: SiO_2 = 9·50, CaO = 50·21, MgO = 21·50, Al_2O_3 = 10·00, Fe_2O_3 = 4·46 NaO = 4·00, and it had a perforated bottom of dolomite, for want of the exchangeable pipes, which could not be obtained, as they had not been manufactured.

The gray Cleveland pig iron, which had been remelted in a cupola oven, contained: Si = 3·030, C = 3·200, P = 1·800, S = 0·030, Mn = 0·450, of which 5 tons 18 cwt. were poured into the converter.

Directly afterward there were poured in (about 20 per cent against the above in-put) 21 to 24 cwt. of flux of a mixture of limestone and oxide of iron (20 to 27 per cent of blue billy), which before had been melted together into firm pieces of the following chemical composition: SiO_2 = 1·000, CaO = 60·000, Fe_2O_3 = 31·600, CO_2 = 6·400. After which the converter was raised upright and blown with 120 cm. column of quicksilver.

By the first charge, after four minutes the line of natron appeared in the spectrum, while during the period of boiling a large quantity of iron was thrown out; after 17 minutes the green lines had disappeared, and by usual hematite melting the process would have been finished with this charge. But the blowing was continued for another 1¼ minutes, the converter tilted, and a proof taken in the usual manner, which still showed a luminous grain proceeding from considerable alloy of phosphor. The process was therefore continued for another minute and 22 seconds, after which no trace of phosphor was perceptible. Now followed the addition of spiegel iron in a liquid state, containing 22 per cent of manganese, in proportion of 9½ per cent to the pig iron put in, which created a violent reaction, and the slag was thrown out in powerful columns of flame. On the pouring out in the casting pans the steel appeared agitated and of soft quality, but rose in the pans and was uncovered in the usual manner. The converter, after running quite empty, did not show the least trace of injury, the borders of the bottom perforators were strongly marked, the joints of the bricks were regular, somewhat darker as the glowing brick matured, but perfectly uninjured. The finished steel showed the following composition: C = 0·171, Mn = 0·160, P = 0·223, S = 0·037, Si = traces.

The blocks were afterward transferred to the gas furnace and rolled in quadruple lengths for rails. The experiments were highly satisfactory, and a special advance to the Bessemer process.

MECHANICAL INVENTION.

An improvement in windmills, patented by Mr. Thomas Dewees, of San Antonio, Texas, consists in arranging three stationary sails between arms on central shaft, so as to obtain double or increased power from the air passing through the wheel.

MIASM AND FEVERS.

Abundant experience has already established the following facts regarding the appearance of intermittent fevers and the causes which are designated as *malaria:* First, that the real cause is to be sought for in the soil, where it is developed in greater intensity under favorable conditions of heat and warmth; second, that this poisonous substance, when the surface is dry, is lifted up a little above the surface by ascending currents, and can then be carried further or raised to a greater height by stronger draughts of air; third, that this substance, the cause of the malaria, is not developed in every soil of the same composition and the same degree of moisture, a circumstance which has repeatedly led to the assumption that it possesses the nature of a specific organism, which requires for its development not only the most favorable conditions, but first of all a *germ* from which it is developed.

From time immemorial the Roman campagna has been known as one of the poisoned plague spots of the earth, hence the interest that naturally attaches to the investigations made there last spring by Klebs and Tommasi-Crudeli.

The malarial powers of different kinds of soil, of water, and of air, were tested. The solid and liquid portions of the former were tested separately. Under the supposition that the germs of the disease were organism, substances rich in infective matter were exposed to those conditions which have been found by experience most favorable to the development of the disease (30° to 40° C., or 86° to 104° F.; plenty of moisture deeper in the soil and rapid evaporation on the surface). Small particles of substances thus prepared were transferred to different liquids for cultivation, and then experiments were made to determine whether, after frequent successive fractional cultivation, the same activity was present as in the substance first employed. Finally, the liquid was mechanically separated from the solid microscopic particles in the cultivated liquids, as in the original, by filtration through gypsum and other filters, and the relative activity of filtrate and residue separately examined. To test the activity of these different substances they were injected hypodermically into rabbits; the temperature was measured every two hours, and the dead body examined. The regular intermission of the fever and the swelling of the spleen and want of other changes were employed as guides and measurements.

The results may be briefly summarized as follows.

1. The malarial poison is found in large quantities and largely disseminated through the soil of malarial districts at a season when people are not yet attacked by disease.

2. At these times it may also be obtained, in especially

favorable places, from the strata of air nearest the surface. To test this, 800 liters of air were thrown with great force and velocity against a glass plate covered with glue solution, to which the solid particles in the air adhered.

3. Stagnant water in malarial districts seemed not to contain the disease, although it may be, like the lake of Caprolace, extraordinarily rich in lower organisms. Their experiments indicate that a large quantity of water hinders the development of malarial poison and renders the germs which are present inactive.

4. By infection with the above fluids, some directly from the soil and others prepared by cultivation and filtration, a fever was produced in the animal of the regular type, with intermissions, which lasted up to 60 hours, and an increase of temperature up to 40° C. (104° Fah).

5. The filtered liquids caused but very slight increase of temperature even when five times the quantity was injected. Even filtering through a double paper filter seems to remove the malarial poison.

6. Animals infected with malarial liquids all showed a swelling of the spleen, and in many of them was found a black pigment.

7. The organisms which were the real cause of the malaria belong to the genus *Bacillus*. They are present in the soil of malarial regions in the form of numerous movable brilliant spores of long oval shape, with a greater diameter of of 0·95 micrometer. They grow, both in animals and in cultivating apparatus, into long threads, which are at first homogeneous, but afterward divide and develop again within the limbs. These spores first form on the walls, but finally the whole interior of the member becomes filled with these little bodies. Owing to their peculiar morphological action they must be looked on as a new kind of bacilli, and have been named *Bacillus malariæ*.

8. These organisms will not develop if atmospheric oxygen is excluded, and hence belong to the class of Aerobii. They do not develop in water, but will in nitrogenous liquids, like solutions of glue, albumen, and the fluids of the body. Sometimes the fibers reach the length of 0·06 to 0·084 mm.

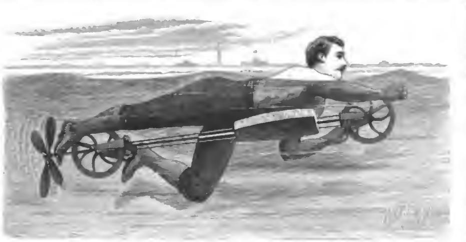
ANOTHER EXTINCT RACE THAT NEVER EXISTED.

One of Mark Twain's best points was made when he described the Indians of Cooper's novels as an extinct race that never existed. Now Professor Stephenson, of the Hayden surveying party in New Mexico, is charged by a Chicago paper with giving a similar report of the Aztecs. He says they are a myth, and that the tribes known as the Cliff-dwellers are to be credited with all the romance attached to the Aztec name. New Mexico is full of their buried towns and cities. During his summer's work in New Mexico, Professor Stephenson made a number of valuable collections, including skeletons and remains of extinct animals. Among his trophies are two gods of Egyptian character, with finely cut features, outstretched wings, and traces of paint on their faces. The Professor brought away specimens of pottery bearing a close resemblance to that unearthed in the ruins of the Old World, and also secured the secret of its manufacture from the Indians, who still make it in New Mexico.

NOVEL SWIMMING DEVICE.

We illustrate herewith one of the most novel applications of machinery that has come under our notice. It is a singular craft without hull or engine, but nevertheless apparently correct in principle and capable of practical application. This swimming apparatus, recently patented by Mr William H. Richardson, of Mobile, Ala., consists essentially of a light frame carrying a float and a longitudinal shaft, having at one end a small screw propeller and provided with gearing for running the propeller.

The swimmer reclines on the float, and, grasping one of the hand cranks in each hand and placing his feet on the two foot cranks, proceeds rapidly and easily, with the head far enough above the surface of the water to be comfortable without extra exertion.



RICHARDSON'S SWIMMING APPARATUS.

The inventor asserts that a swimmer with one of these machines can, under favorable circumstances, make from four to five miles an hour without undue exertion.

Further information in regard to this novel device may be obtained from the inventor.

Substitute for Cod Liver Oil.

According to the New York *Medical Journal*, Dr Thomas A. Emmet, of this city, in his recent work on the "Principles and Practice of Gynecology," recommends the fat of pork, properly prepared, as an excellent substitute for cod liver oil. A portion of a rib, free from lean, is selected and soaked in water thirty-six hours to get rid of the salt. It is then boiled slowly, the water being often changed, until the meat is thoroughly cooked. It is to be eaten cold in the form of sandwiches, cut very thin. Thus prepared, it forms, according to the author, a very nutritious and concentrated article of diet, and one which can often be retained by irritable stomachs.

JUVET'S TIME GLOBE.

For many years it has been the ambition of horologists to apply by some mechanical device a motor to a terrestrial

JUVET'S TIME GLOBE.

globe, that, while it should show the exact diurnal revolution, should also be so constructed as to have utility as a timepiece. Various and ingenious methods have been devised, putting a clock in a case and projecting above its base a rod with a gear coupled into another on the equatorial portion of the globe. A French inventor made a globe in the shape of a dome, exhibiting only the northern part of the earth, and by an impelling mechanism turned it on its axis. These and other crude and cumbersome mechanical devices prevent any other than a rigid position, and one that could not accurately illustrate the earth's polar position. A sphere that shows but a half globe, or one that necessitates a fixed horizontal or perpendicular polar projection, is calculated to mislead and not instruct. The requirements for a perfect scientific instrument of this kind are excellence as a time-keeper, accuracy, clearness, and completeness of map surface. It must admit of being easily examined, and should be capable of any inclination necessary for terrestrial or other planetary illustrations.

Any exterior mechanism precludes these essential requirements.

Mr. Louis Paul Juvet, a native of Neufchatel, Switzerland, but for some time a citizen of the United States, after years of patient effort has devised a time globe which avoids the imperfections of its predecessors. This globe, which is shown in the accompanying illustration, has a chronometer movement in its interior. The shell that envelops the works and protects them against accident or dust is very light and uniform in thickness, allowing the mechanism to turn freely, equally, and in perfect balance. The globe surface is as hard and smooth as a sheet of steel, being made of an entirely new material, which is unaffected by moisture, or heat, or cold. The meridian ring used for the support of the globe at its polar extremities, graduated for the measurement of latitude, is placed at some distance from the sphere to give lightness and beauty, and also to admit more easily examining the globe surface. It is held in any desired position by a simple swiveled clutch and holder. At the northern end the meridian ring is expanded into a holder for a transparent heavy plate glass clock dial, with the usual hour figures and minute marks. The hands are under the dial and the time is easily read, yet the dial is not an obstacle to the free examination of any portion of the globe. At the equator a zone dial encircles the globe, the hour figures and minute marks on which, by following the meridian line of any locality to it, gives the exact time of any place. In the illustration the hands of the clock show 12:20, the local time of New York city, the meridian line of which, it will be seen, stands also before 12:20 P.M. on the equatorial dial. It will be noted, also, that San Francisco is yet on the morning side of the meridian, while London is almost in darkness, and stands before 5:16 evening on the equatorial zone.

One half of the equatorial zone is darkened, being nearly black at midnight and shaded lighter on the left to 6 A.M., and on the right to 6 P.M., thus showing at a glance which part of the world is in daylight and which in darkness. The automatic motion of the globe, reproducing on a small scale the very movement of the earth, illustrates the phenomenon of day and night, and solves a problem that, simple as it is, is yet incomprehensible to many.

This globe is, in fact, a miniature earth in position and motion, being lightly and yet strongly made, with every portion of it visible. A clock and globe gives local and universal time with accuracy. It measures by its motion the comparative, and by the simplest computation the exact size of any country as it passes the meridian ring and equatorial zone. It can be placed in any position without derangement, and we are informed that it cannot be fractured by blows. It is unaffected by climatic changes. It is covered by a map which is a special edition of the celebrated Edinburgh (Johnston's) maps corrected to date, having all the recent political changes and geographical discoveries, and also blue lines indicating average winter, and red the average summer temperature of every country on the globe; the water being represented in blue of a desirable shade clearly shows by the white lines the ocean currents. Whenever a change in the boundaries of countries, addition of States, or important discoveries make it desirable, this globe can be remapped at a nominal expense. The axis of the earth is represented by a gracefully shaped arrow, the feathered end of which is used as a stem winder for the clock within, which runs four days, and is regulated from the outside. The works are simple, and can be taken apart or repaired by any mechanician.

It received the highest award of the Centennial Exhibition at Philadelphia, and has the most cordial indorsement of scientists at home and abroad. It is mounted simple or ornate, to meet various tastes. It is a fit ornament for any library, a valuable adjunct in every business office, and a necessity in every institution of learning. This beautiful piece of apparatus is patented in this country and in Europe.

For further information address Messrs. Juvet & Co., Canajoharie, N. Y.*

A Safe Investment-Dividend Every Week.

The commencement of a year and the beginning of a volume are the best periods for subscribing for either magazines or newspapers. The SCIENTIFIC AMERICAN at this time embraces both these conditions. A new volume commences with the new year, and any person not a subscriber into whose hands a copy of this paper may fall is invited to become a subscriber at once and receive its weekly visits during the year 1880. Nothing will return a better income than $3.20 thus invested. Dividends every week without any liability for assessments, payable at the home or office of the subscriber, free even of postage. Try the SCIENTIFIC AMERICAN for 1880.

FISH CULTURE IN CANADA.—A Canadian official report states that during the fiscal year 1877-78 a sum of $20,088 was expended in restocking waters with fish, the number of young fish distributed during the year exceeding 27,000,000.

*See advertisement on another page.

AGRICULTURAL INVENTIONS.

Mr. Henry Bell, of McGregor, Iowa, has invented an improved centrifugal churn, which he claims is simpler in construction and of superior efficiency to others now in use.

An improvement in cotton picking machines has been patented by Mr. Frederick F. Trenks, of Round Top, Tex. This improvement relates to machines for picking cotton from the plants by means of a picking cylinder provided with curved fingers and flanges extending beyond the picker fingers.

An improvement in cultivators has been patented by Mr. Peter Gerges, of Skippack, Pa. The object of this invention is to furnish an improved cultivator which shall be simple, convenient, and effective. It consists in a single beam combined with standards and auxiliary blocks and bolts.

Mr. Marion Small, of Crawfordsville, Ind., has patented an improvement in combined grader and stalk cutter which consists in combining a drum and loose semi-cylinder with mechanism for operating them.

THE BASKET FISH.

BY H. C. HOVEY.

This elegant ophiuran (or serpent star) has a measure of historic as well as scientific interest. Hon. John Winthrop, who deserves to be called the pioneer of American naturalists, laid aside for a while his cares as Governor of Connecticut, saying, "We shall omit other particulars here, that we may reflect a little upon this elaborate piece of nature." His account of "A Very Curiously Contrived Fish" was published, in 1670, in the "Philosophical Transactions of the Royal Society" (vol. iv. and vol. vi.); and though not up to the present standard of exactness, it is quite accurate as well as graphic, and is remarkable as being the first purely scientific paper from New England. With excusable hesitation, and giving his reasons for doing so, he called the new and nameless fish "*Pisces-echino-stellaris-visciformis*," which has since yielded to the shorter title of *Astrophyton*. He considerately suggested also the English name of basket fish, on account of its resemblance to wicker work; and this is still the name by which it is known among the fishermen from Nantucket to Labrador.

For full details as to the geographical distribution, anatomical structure, and special marks of the entire family of *Astrophytidæ*, the reader is referred to Lyman's "Catalogue of the Museum of Comparative Zoology," at Harvard College, and other scientific works. The species peculiar to our coast is named for the celebrated Agassiz, and described by his son in "Seaside Studies." It is perhaps the least useful and most ornamental creature caught in the Northern Atlantic; and specimens, dried or in alcohol, adorn many cabinets.

The body of *Astrophyton Agassizii* is a pentagonal disk, surrounded by arms. The disk, as measured by me in a single specimen, has a diameter of two and three quarters inches; and one of the arms is, in its entire length, nine inches, but as it lies coiled up, like a basket, it is about eight inches across the whole. The size varies with age, but the above is about the average, many being less than half as large, and others twice as great. The upper side of the disk has ten radial ribs bearing short, blunt spines. The mouth is on the under side, and central. It is set with spiniform bristles hiding twenty-four thorn-like teeth. From around the star-shaped mouth branch five stout arms, each of which is divided at the edge of the disk. The animal is wholly covered with an epidermis, granulated above, but smooth beneath, except that it seems to have a double line of stitches under each arm. The general color is light buff; but the inter-brachial spaces in the living animal vary from dark purple to bright pink.

The constant division of each arm at regular intervals into two smaller ones is a most remarkable peculiarity of the *Astrophyton*. Each of the five main branches is divided into two, making ten in all; each of the ten is divided, making twenty—and so indefinitely down to the least visible filament. Winthrop counted 81,920 of these "small sprouts, twigges, or threds."

The statement seems incredible. But take a single branch and count its bifurcations. There are fourteen. A simple arithmetical process shows that there are then 40,960 arms. Had there been one more fork, that number would have thus been doubled to 81,920, as Winthrop has said. No doubt the number is doubled again in larger specimens. One can readily see that it is not easy to represent pictorially such a living labyrinth; and the difficulty is increased by the fact that, on capture or disturbance, the creature instantly folds its more than Briarean arms closely about its body, shrinking from the touch like a sensitive plant, and assuming the basket shape from which it gets its familiar name. The attempt to untwist these coils generally ends in breaking the delicate but tenacious threads.

Last summer I had a rare opportunity for examining living *Astrophytons* while on board the steamer Speedwell off Cape Cod. Thousands of rare and curious marine specimens were obtained by steam dredging for the U. S. Fish Commission, under the superintendence of Prof. S. F. Baird, and the special direction of Prof. A. E. Verrill. Sometimes only a few basket fish would come up clinging to corals and sponges. Again, a few more would be scattered through a netful of flounders, skates, and fishing frogs. But after one memorable cast of the great trawl (17 feet wide and 50 long), there were hauled in an immense number. The water was 200 feet deep, and long before the beam of the trawl emerged, the golden gleaming of the *Astrophytons* was visible through the green waves. The weight was so great that a special lifting apparatus had to be put beneath to keep the net from breaking. As the huge mass lay writhing on deck, the sailors and others eagerly picked out the specimens most easily disengaged from the net and from one another. After about one thousand of all sizes and varieties had been secured, we grew weary of the work, and the remainder were torn off in clusters and mats and thrown overboard, and the fragments scooped up with shovels. The entire number was estimated at fully 5,000. The trawl had been dragged over one of their favorite places of resort; or they may have the custom, ascribed to star fish, of rolling themselves together in a ball and floating with the ocean currents, and in that case we must have captured an entire colony.

The basket fish is a voracious feeder, and its peculiar construction aids it in taking its prey. The microscope shows each arm and spine to terminate in a minute but sharp hook. According to Agassiz, the animal, in moving, lifts itself on the extreme end of its long arms, standing as it were on tiptoe, so that "the ramifications form a kind of trellis work all around it, reaching to the ground, while the disk forms the roof." This latticed bower is but a cruel trap for entangling heedless little fishes and shrimps, whose escape from those deadly coils is as hopeless as the efforts of a fly to break loose from a spider's web.

THE BASKET FISH.

Professor Huxley on Snakes.

The opening lecture at the London Institution for the season was lately delivered by Professor Huxley, F.R.S., to a very crowded audience, his subject being "Snakes," than which, he said, there were, in the popular apprehension, few animals more symbolical of degradation and horror. Quoting the primeval curse in Genesis, he remarked that no creatures seemed more easily destroyed by man, and few less able to defend themselves. Few wounds would be less harmful than a snake's bite were it nothing more than the sudden closing of the teeth. Yet there were not many animals gifted with so many faculties. It can stand up erect, climb as well as any ape, swim like a fish, dart forward, and do all but fly in seizing its prey. The destructiveness of snakes to man was illustrated by the fact that 20,000 human lives are yearly lost in India by their poison, and it might safely be said that they are a more deadly enemy to our race than any other beasts of the field. Professor Huxley spoke first of the three classes indigenous to our own climate—the ringed snake, the coronella, and the viper. Of these the viper alone was venomous, which the differences between its structure and that of the harmless British snakes helped to explain. It might be that the reason there were no snakes in Ireland was the multiplicity of its other plagues. Everybody must be struck with the beauty of the harmless snakes, which formed the overwhelming majority—especially the grace with which they wreathed their bodies into circles, and their fine eyes. The venomous snakes were not so beautiful. None admired our native viper, with its yellowish scales. To adults its bite was far seldomer serious than to the young. Passing to snakes in general, of which there were many hundreds of distinct species, the lecturer illustrated in great detail the adaptation of their organization to its manifold work. Very graphic was his description of the manner in which some of the more destructive snakes dart suddenly on their prey, twisting themselves round its body, crushing it into a shapeless and writhing mass, and at last swallowing it whole. He pointed out some very curious arrangements in the anatomical mechanism and jaw bones illustrative of the statement that the snake cannot properly be said to swallow his prey; he holds on to it rather, gradually working it down its throat in a most leisurely manner, but never letting it go. He would take a sleep for six weeks before giving up his task, and if the morsel were really too big would sometimes die in the effort to get it down. Of course, the snake required a very fully-developed and effective apparatus of salivary glands for this purpose. The poison bag of the venomous snakes was nothing but a modification of the salivary glands of the harmless species, the structure of both kinds being in almost all respects not only parallel throughout but almost identical. As another instance of the close relationship, it was shown that the sharp channel needle which conveys the poison of the cobra and its congeners is nothing but the development of the tooth which these murderous reptiles possess in common with innocuous snakes. The fact that the salivary gland was the poison laboratory of the deadly snakes, as well as the known properties of the saliva of dogs or other living creatures affected with rabies, appeared to Professor Huxley to point out the direction in which lay the solution of the difficult problem of the cause of snake poisoning, and of a possible antidote against it. At present there was no man living who could heal the bite of the cobra, except by cauterization in very fresh cases.

Jet.

The mineral itself is nothing more nor less than a species of pitch coal, found in detached masses, grained like wood, splitting horizontally, light, and moderately hard. It is often confounded with "cannel" coal, but it is quite distinct. Cannel coal is much harder than jet, has no grain, and splits in any direction. Jet is not easily fused, and requires a moderately strong heat, burning with a fine, greenish-white flame, and emitting a bituminous smell. The particular value of jet is, of course, its susceptibility for taking on a fine polish. Jet abounds more or less all over the world

In England it is found in greatest quantities in the neighborhood of Whitby, in Yorkshire. There it is mixed with bitumenized wood and coniferous trees in the upper lias or alum shale of the district. In Prussia it occurs in association with amber, and is named by the amber diggers "black amber," a phrase which seems to have traveled to Italy, for the mineral is there sometimes called "ambra nera." This term is more applicable from the fact that jet, like amber, becomes electrical by friction.

There is a belief that amber and jet come from one source: that amber is a fossil gum, while jet is the trunks and the branches of the trees more completely bitumenized and freer from earthy impurities than cannel and other coal. Indeed M. Magellan goes so far as to say that jet is a pure amber, differing only in color from the undisputed variety. In France large quantities are found in the department of the Aude, where a large number of artisans find steady employment in fashioning it into rosaries, religious beads, and ornamental trinkets when fashion demands them. In Spain jet of a very high quality is found at Villaviciosa, in the province of Asturias, and is manufactured principally at Oviedo

But during the present century jet became a popular ornament, and now probably in not a few minds Whitby and jet are inseparably associated. The article acquired considerable value, and some twenty years ago jet ear-rings ranged in value from 5s. to 30s. a pair. Then a lucrative trade was carried on at Whitby, jet miners scooped out pits in the pretty Cleveland hills, and a large number of men and young women in Whitby found employment in carving the precious coal into articles of feminine ornament. But the success of the English jet trade brought competition into the field, and with it imitation, which latter first demolished the genuine jet trade and then committed suicide. Cheap and inferior jet was imported from France and Spain, and what was wanting in value with regard especially to the former of these was amply compensated for by the superior taste displayed by the French artists in designing the ornaments. Then colored glass invaded the jet market, but the greatest blow of all was the invention of vulcanite. Vulcanite is a simple compound, its only components being India rubber and sulphur, combined by the pressure of steam. This substances has many advantages over real jet. It is equally black, more tenacious, and consequently more suitable for watch guards. It is also more easily worked, being manipulated while hot, and is not more than one-tenth the price of jet.

Vulcanite became the rage for a time, and jet fell into disuse. But the manufacturers of vulcanite, not satisfied with their victory over genuine jet, fell into evil ways, and succumbed to the great temptation to adulterate the genuine vulcanite. The addition of *litharge* and whitening cheapened the vulcanite considerably, and for a time did not interfere with its appearance; but the pernicious effects of the alloy soon tells, and the "jetty black" of vulcanite turns to a faded green. The vulcanite rage passed over, and fashion in its reaction from the somber ornaments flew to the opposite extreme, and set up a "silver mania." There are now signs that this is on the wane, and the leaning for oxide of gold, by which the rapid transition from jet to silver among the masses was slightly interrupted, does not seem likely to come into favor again. In this state of matters, says the *Colliery Guardian*, comes the announcement from Whitby that there are signs of a revival in the jet trade.

The indications of a resuscitation of the industry are certainly tangible, but while not desiring to throw a wet blanket on industrial hopes of any description, we would venture to question whether there are any real grounds for supposing that the manufacture of jet will ever experience anything like a real revival. It may be true that the stocks of jet ornaments at Whitby are being exhausted, but what does that prove? The fact is that jet has been for some years so low in value as to be hardly "worth keeping," and probably hardly worth carrying away. Ear-rings which in the halcyon days of the jet trade would have fetched 30s. a pair, retail price, could, during recent years, have been had for 5s., and what were 5s. ear-rings formerly are now worth about 2½d. The case is the same with vulcanite, and no ornament of this composition which might have cost 2s. ten years ago, could now be bought for 1d. or 1½d., and should fashion in its caprice lend a favorable eye to "black jewelry," and jet consequently acquire an increased value, that moment would the market be flooded with vulcanite. How cheap soever jet ornaments may be made, vulcanite will undersell them, and as vulcanite looks equally well, is more durable because less brittle, and is in many respects superior, any resuscitation must be ephemeral, and the sparkling coal from Whitby must succumb before a base preparation—a fact more galling than that which befell "The jelt or marble farre from Ireland brought," which yielded in Spenser's imagination to the "Stone more of value, and more smooth and fine."

NATURAL HISTORY NOTES.

Origin of the Name "Puss."—Says the editor of the *Zoologist*, the cat was worshiped in Egypt as a symbol of the moon, not only because more active at night, but from the priests conceiving that the contraction and dilatation of the eye afforded an emblem of the increase and decrease of the moon's ever-changing orb. In the British Museum may be seen several figures of the cat-headed goddess Pasht, under which name the moon was worshiped by the Egyptians—Pasht signifying the face of the moon. "Pasht" is compounded of the consonants P, SH, T. T is the coptic feminine article, which, being omitted, the same is reduced to P, SH, but the aspirate SH should be the tenuis S, and then the word would be PS, as in Hebrew, and which may be pronounced "pas" or "pus" (puss). It thus appears that our familiar name for the cat can boast of a very high antiquity.

A Grass Fatal to Sheep.—One remarkable fact connected with the botany of Queenstown is, that a grass, which grows locally abundant in the more northern portions of the colony, *Aristida hygrometrica*, is fatal to sheep by reason of its long, sharp, tripartite awns getting entangled in the wool and ultimately piercing the skin and penetrating to the viscera of the thorax and abdomen, causing death after prolonged wasting and suffering; the heart, liver, kidneys, etc., are sometimes, on dissection, found pierced by these mischievous awns in all directions.

The Influence of Soil on Plants.—Sufficient attention, perhaps, has not been paid to the study of the influence of soil in producing variation in plants, and changes and modifications of their constituents. A writer in the *Pharmaceutical Journal* has recently called attention to the fact that it is rare to find the *Viola odorata* with blue flowers on a calcareous soil in England, the prevailing color being white. One of the genus of violets has lately been examined by Dr. König, who finds as much as 21 per cent of zinc oxide in the ash of the plant. This violet is so distinct in appearance that it has been considered a good species by some botanists, and called *Viola calaminaria*. But by most authorities it is regarded as a variety of *V. tricolor*, its characteristics being due to the soil on which it grows. It appears to be restricted to soil containing zinc, and thus serves to indicate the presence of the metal in the soil, where it might not otherwise have been suspected. The extent to which medicinal preparations may be affected by the soil upon which the plants they are prepared from have grown, is illustrated by an experience of M. Gérardin, pharmacien, in the Marne department. Having prepared some extract of belladonna from a defecated juice, he found it after some weeks full of granulations. These proved to consist of a mixture of silicate and chloride of potassium equal in weight to 6·8 per cent of the original extract. It was then remembered that the belladonna plants used had been collected from a spot which had long been frequented by charcoal burners for their operations, and the remainder of the explanation was to be found in the decided fondness of solanaceous plants for silica and potash.

Changing the Color of Feathers in Live Birds.—It is stated in Kidder and Fletcher's "Brazil" that the Indians have a curious art by which they change the color of the plumage of many birds. They pluck out a certain number of feathers, and in the various vacancies thus occasioned infuse the milky secretion made from the skin of a small frog. When the feathers grow again they are of a brilliant yellow or orange color, without any mixture of green or blue, as in the natural state of the bird; and, it is said, the yellow feather will ever after be reproduced without a new infusion of the milky secretion.

Leaf Structure.—Long ago Nehemiah Grew published some very accurate drawings of the structure of leaves and leaf stalks—so far as the disposition of the fibrous tissue is concerned. Quite recently M. Casimir De Candolle has investigated the same subject with special reference to the distinction and resemblances to be drawn between allied species of the same family. It is found that different species of the same genus sometimes accord, but sometimes differ notably in this part of their anatomy. For this reason the classificatory importance of these differences is low, although they may often be turned to good account in the discrimination of related species. The essential fibro-vascular system of the petiole, as displayed on a cross section, forms either a closed ring or an arc open superiorly between the outer or cortical, and the inner or medullary tissue. In the first case it is said to be closed or complete, in the second open or incomplete. Very commonly this is the only vascular system of the petiole, ribs, or veins. Not rarely there are additional or accessory bundles, sometimes external to the essential system, or *intracortical;* sometimes within the arc or ring, or *intramedullary;* occasionally there are both intracortical and intramedullary bundles. Generally plants of the same natural order will agree, at least approximately, in having the closed or open system, and in having or wanting the accessory bundles without or within. But while *Acer pseudo platanus* has a well developed intramedullary cord, *A. platanoides* has none, and in general the maples are divided in this respect quite independent of other characters; and the difference is similar and equally marked between the species of *Æsculus*. The oaks, which have been made a special study in this regard, appear to be somewhat equally divided between species provided with and those destitute of intramedullary bundles; but related species generally belong to the same category, although not always. For in one case two species, of doubtful distinction until now, are confirmed by the discovery of an anatomical difference of this sort. All the birches examined want the intracortical bundles, and the principal system forms an open arc, and one or two alders nearly agree with them; while the others have a closed ring and are furnished with intracortical bundles.

Barometric Plants.—Linnæus, in his "Flora Lapponica," writing on the white clover *Trifolium repens*, states that it is a common practice to predict a coming storm by an inspection of this plant, for when the air is hot then the leaves hang down, whereas when there is moisture in the atmosphere the leaves are erect. This observation, he remarks, holds good not only for the clover, but also for almost all plants which have declinate stamens. All the flowers, too, he adds, generally converge when a shower is impending, as though they knew that the water would interfere with the fertilization of the plant, for when the fertilization has been effected no such convergency is exhibited. He instances *Mimosa*, *Cassia*, *Bauhinia*, and their allies, as plants whose leaves converge every evening, even though there be no diminution of temperature, and concludes by asking the still unanswered question, What is the cause of this sensitiveness, and what change is there in the night air beyond the absence of light and heat? Dr. Hooker states that the leaflets of *Oxalis* are pendulous at night, and often sensitive to light. Of *Anagallis arvensis* he remarks that the corolla opens in clear weather, and a number of plants besides those specified exhibit the same phenomenon, and doubtless obey the same law. What is this law?

Some Facts about our Territories.

The annual report of the Secretary of the Interior contains a large amount of information with regard to the present condition and future prospects of our Territories, furnished by their respective Governors. The more important facts are as follows:

UTAH.

The snows which fall in the mountains and remain there during the summer provide the main supply of water necessary for irrigation. During last winter but little snow fell, hence the short supply and the deficiency in the crops. Some of the largest streams in the Territory have gone dry, something never before known to the oldest settlers. Even the Great Salt Lake has fallen four or five feet. Stock has suffered severely on the mountain ranges.

Attention is called to the defects in the present mining laws, and suggestions are made as to the amendments necessary. The Governor holds that "a man's patent to his mine should be a perfect title to the property covered by his patent, and parties purchasing patented mines should be required to trace titles no further than to the patentee." He also favors the granting of a larger surface area, and the confinement of rights within the lines granted. In other words, a mining claim should be as definite, so far as boundaries go, as that of a city lot, and the right to work should be confined within the perpendicular lines of its side and end. Following the dip of mineral veins on the ground of other parties is, in his opinion, the fruitful source of litigation. The mining interests of Utah are reported as in a most excellent condition; the introduction of new methods of reducing ore causing larger profits to be realized than were possible in former years.

From the year 1870 to 1878, inclusive, the Utah board of trade reports, as taken from the books of the Utah Central Railroad, the shipment from Salt Lake City of 76,912 tons of lead ore, 109,276 tons of argentiferous lead bullion, and 8,197 tons of lead, worth in the aggregate about $40,000,000. The value of the ores taken out during the past three years was $18,558,805 48; of this $1,379,446 was lead, the remainder being the precious metals.

During the past year 150 miles of additional railroad have been built.

WASHINGTON TERRITORY.

The Governor of Washington Territory reports satisfactory advancement in the development of the agricultural, manufacturing, mining, and commercial resources of the Territory. Its isolated position and the misconception existing in relation to its climate and productions have tended to prevent its rapid growth.

Situated between the 46 and 49° north latitude, its climate is generally believed to be cold, and yet the results of careful observation show that the climate of Western Washington is mild, during the winter months the temperature seldom falling below the freezing point. A tabular statement is given, showing the character of the climate throughout the year, based on accurate meteorological observations taken at Port Blakeley, on Puget Sound, in latitude 47° 36'. It would appear from this statement that the lowest temperature during a period of twenty-six months was 25° above zero. The highest in 1877 was 88°; in 1878, 94°; and in 1879, 86°.

The average rainfall is about the same as in the Eastern and Western States. The mildness of the climate is due to the presence of the thermal current, having its origin at the equator, near the 180° east longitude, Greenwich, and which flows northwardly to the Aleutian Islands, where it separates, one branch flowing eastwardly, along the peninsula of Alaska, and then southwardly, along the coast of British Columbia, Washington Territory, and Oregon. The prevailing winds during the winter are from the southwest, and those of the summer from the northwest.

The temperature of Eastern Washington as compared with the western division is slightly higher during the summer and lower during the winter. The average annual temperature is reported as follows: spring, 52°; summer, 73°; autumn, 53°; winter, 34°.

All the cereals, fruits, and vegetables grown within the temperate zone can be raised in Washington Territory. Eastern Washington is the great wheat field of the Territory, with a capacity for upwards of 100,000,000 of bushels. The average yield is 25 bushels to the acre.

The exportation of wheat during the present year will be upwards of 60,000 tons. Transportation facilities are inadequate to the demand, and will so continue until the obstructions are removed at the Dalles, Cascades, and other points on the Columbia River.

The exports of the Territory have been the cereals and wool, flour, live stock, canned salmon, fish, lumber, coal, potatoes, hops, hides, barrels, lime, etc. The export of coal during the year was 190,000 tons; lumber, 150,000,000 feet; salmon, 160,000 cases of 48 cans each, or a total of 7,680,000 cans.

The population of the Territory on the first of May last was 57,784, an increase of 7,278 over last year.

NEW MEXICO.

The three leading interests are mineral, grazing, and agricultural; manufacturing is confined almost exclusively to jewelry, of which very exquisite work in filigree is produced in Santa Fé, mostly from gold and silver native to the Territory.

But little advancement has been made in agriculture. Its present condition is very primitive, the old Mexican wooden plow still holding preference with the farmers. The little produced is with a view to satisfy local consumption. Wheat and oat fields, as rich as any in Illinois and Minnesota, may be seen six or seven thousand feet above the level of the sea. The grape is easily raised, is free from disease, and affords a good quality of wine. The area of agricultural production cannot be even approximately given. All irrigable lands, wherever found in the Territory, may be classed as productive or farming land.

The Rio Grande Valley, about four hundred miles in length by an average of five in width, has a soil light, warm, and surpassingly rich. Not more than one tenth of this land is occupied. Fruits succeed admirably in this locality, although the varieties at present cultivated, except the grape, are of the poorest kind. The valley of the Pecos River is almost entirely devoted to grazing purposes. Like the valley of the Rio Grande its soil is rich when properly irrigated, and its climate healthy and delightful. The Mesilla Valley, like the two mentioned, is inviting both for agricultural and grazing purposes. The vast tracts of table lands bordering the valleys are too high for irrigation, but yield grasses of the richest kind for cattle and sheep raising. With such unlimited ranges, stock raising has become a profitable industry, with promise of substantial growth in the future.

In relation to the mineral resources, the governor is of the opinion that New Mexico will compare favorably with her neighbors in the yield of precious metals. Although the era of prospecting has hardly given place to that of development, enough is already known to warrant the assertion that the Territory is well stored with gold, silver, iron, copper, lead, zinc, mica, gypsum, coal, marble, and precious stones. The coal croppings in Socorro and Colfax counties, and on the Galisteo River, indicate an inexhaustible supply both of bituminous and anthracite. Cannel coal is also found in the Territory. No attention is being paid to the production of iron, although it is to be found, more or less, in every mountain range. The same may be said of copper, lead, and mica, while gypsum is so common that it is hardly a merchantable commodity. Silver and gold are to be found in many localities, and many mines are being worked to advantage. The great drawback at the present time is the want of water.

Mention is made of the numerous hot springs in the Territory. The waters of many of these have well determined curative properties, and at Las Vegas elaborate preparations are being made for the care and entertainment of guests and invalids.

An approximate estimate gives the territory a population of 125,250. The Pueblo or town Indians are estimated at 9,000 and the wild Indians at 14,500.

The report concludes with a statement giving the results of certain observations relating to the climate of the Territory. From this it would appear that the central portion has a delightful and healthy climate. The prevailing diseases are rheumatism and catarrh, while consumption is almost unknown.

DAKOTA.

Dakota is the largest of the organized Territories, containing about 150,000 square miles, or an area nearly equal to Pennsylvania, New York, and all the New England States combined. The Governor reports the present year as one of unexampled prosperity. Although the crops in some of the southeastern counties were partially destroyed by drought and grasshoppers, those of other sections have been excellent.

The products of the Black Hills mines are estimated at $3,000,000 for the past year. Immigration has been larger than in previous years. In the absence of accurate returns, the population of the Territory can only be approximately given at 160,000.

Railroad facilities are being largely increased, about 400 miles being already completed, with a promise of at least 500 miles by January.

The Governor favors the division of Dakota, and is of the opinion that two or three Territories could be advantageously formed out of the present area.

IDAHO.

The year has been one of thrift and prosperity. Agriculture and mining have been remunerative, schools have been encouraged, and good health has prevailed. With the advent of railroads and improvements in highways a large immigration may reasonably be expected.

The numerous streams of Idaho afford facilities for irrigation in those sections where rain is infrequent, while the lands of Northern Idaho can be cultivated without resort to artificial means. The Governor describes the methods employed for irrigation and the encouraging results which ensue therefrom. He favors government aid in the effort to reclaim lands for cultivation, and the adoption of some system by which large tracts may be secured by individuals willing to expend their capital in building the necessary works for irrigating purposes.

The timber supply of the Territory is abundant, but a reckless disregard for the public interests has marked its destruction for years past. In addition to the waste of timber by man, the fires which constantly sweep the mountains destroy a greater amount than is taken for consumption by the entire population.

Since 1868 the gold and silver product of Idaho has amounted to about $67,000,000. As there is no law requiring miners or public officers to make returns, only approximate estimates can be given. The improved methods employed in reducing the ores and the increasing facilities for transportation will in the future largely augment the annual yield of the precious metals.

The mining laws especially need revision; and in the Governor's opinion Congress should pass a comprehensive and carefully revised act, covering the mining field, clearly defining all rights and remedies, and leaving but little scope for local legislation. It is also suggested that Congress interpose for the protection of agricultural interests by preventing the monopoly of the streams of the Territory by private individuals or corporations. The usufruct of natural streams should be guarded by stringent laws, so that the water needed by the many should not be monopolized by the few.

The finances of the Territory are reported to be in a satisfactory condition, and the debt of the Territory is gradually being reduced.

No reports had been received from the Governors of Arizona, Wyoming, and Montana.

Kansas Natural Lime.

Among the natural products, some of them possessing very peculiar characteristics, which the young and growing State of Kansas contains, is a singular substance, lying in very considerable beds, and called "Kansas native lime." It is, says a correspondent of the *American Architect*, of a beautiful white color and of a very fine-grained texture. It is soft, smooth, and readily made into a plastic condition by the admixture of a suitable quantity of sand and water. The mortar thus made up has seemingly identical qualities to the best mortar as made from superior limes selected from kilns where the lime rock which had been employed for burning had been of the very purest nature.

The native lime is a sort of whitish and pure white clay, lying disposed favorably in beds more or less horizontal in their position. These beds are seen to be outcropping along the borders of certain streams and in the breaks of hills, and in such places the beds can be worked entirely above the water level. Experiments which have been performed by workmen and artisans in Kansas have exhibited the fact that Kansas lime mortar serves as good purposes as any other usual styles or kinds of mortar, and even better than some of the artificial mortars, especially for nice inside work. The tendency of this newly discovered deposit of pseudo-lime, when made into mortar for walls and stonework or plastering, is to soon set and harden. Another remarkable quality then noticed is its turning immediately to an intense whiteness. The beds are very thick and easily dug; so that large quantities of the substance can be thrown up, and at once applied to use. Beside its ready adaptability to purposes of mortar, it has also been applied to the purposes of whitewashing, and in this respect it has been accepted as an admirable substitute for lime prepared artificially. These immense beds of pseudo-lime occur in localities where railways of Eastern Kansas can readily be utilized for shipping the material to all parts of the country. It is, perhaps, presumable that upon the spread of the knowledge of this fact, the excellent natural mortar lime and whitewash lime from these native deposits may become articles of export, especially as improved styles of building and more permanent structures everywhere in Kansas, Missouri, Nebraska, Iowa, and Illinois are growing to be more and more the requisites of the times. The great pseudo-lime beds or native beds of calcined lime rock are a geological phenomenon. They are difficult to account for in any plain or obvious manner. They have a close resemblance in their physical condition and looks, and in their feel or touch, and in their action when mixed to form mortar, to the best mortars made in the usual ways with the very best of limes. Can it be possible that some of the unknown laws of electro-magnetism and of terrestrial magnetism, which cause certain metamorphisms to occur in metalliferous beds, are likely to be discovered as the laws also which set the elements at work to alter the chemical conditions of this singular lime rock stratification? Can the problem of their origin and nature be clearly or satisfactorily accounted for in any other way? Does such a strange product as this occur in any other section of our continent?

Bad Work Makes Bad Trade.

The statistics of railway accidents during the past year in England, among which were 937 failures of tires, 346 failures of axles, and 1,377 broken rails—leads a London writer into a strain of moralizing which may contain some sound warnings, if not practical lessons to American manufacturers. He says: "Two thousand six hundred and seventy three flaws and failures in wheels, couplings, and rails. Any one of these sufficient to cause a fatal calamity. No more shameful illustration of the way in which English manufacturers have been meeting competition could be put forth. Bad iron, ill-worked steel, and 'scamped' workmanship; these are the chief causes of the 'failures' in tires and axles and rails. It has become quite an old story, unfortunately, this relaxation of honest pride and commercial honor during the last few years. Loaded cottons, shoddy cloths, rotten iron, ill-tempered steel, poorly ground cutlery, short weight, and adulteration of all kinds have taken the place of the genuine English goods by which the old country had made her reputation. Masters driven to despair by trades-unions and strikes, by prohibitory tariffs abroad, have laid down their old-fashioned honor and put size into their calico, rags into their cloth, worthless 'brands' of raw material into their tires and rails, third-class goods into first-class wrappers; and so trebled the speed with which commerce has been running down the hill of stagnation. One of the best signs of the day is an occasional outspoken acknowledgment of the absolute necessity of turning out once more genuine goods, the utter, absolute necessity of rehabilitating the English name in the markets of the world, and it must be said for many solid old firms that they have never sacrificed their reputation by a reckless attempt to meet exceptional times and competition. It has, nevertheless, been a common thing for Sheffield to take inferior foreign goods and finish them, more particularly by putting a local trade-mark on them 'for a consideration,' thus lowering the standard of Sheffield goods. Time was when the woodmen and farmers of America and the Colonies would use nothing but Sheffield axes. It is not only the splendid character of American manufactures in this direction, but the turning out of bad work under Sheffield trade-marks, that has made the American ax popular not only elsewhere, but here in England. An English saddle used to be regarded as the acme of strength and perfection; but Prince Napoleon lost his life through the giving way of a portion of his saddle fixings, the bad workmanship and material of an English manufacturer. Sad lessons these! They are being laid to heart by many traders, and it is believed that with the present improvement in business some regard will be paid to one feature of the moral of our national misfortunes. Here and there the workingmen seem unwilling to co-operate with the employer in meeting the new demands; but, on the other hand, there are evidences of an earnest desire to make the most and the best of the trade revival."

Hitherto American productions have won their way by honesty of workmanship not less than superiority in practical fitness. It is sincerely to be hoped that whatever may be the results of the increasing competition at home and abroad, any lowering the high standard of honesty thus far maintained by our manufacturers will not be among them.

Electrical Poetry.

The late Prof. Clerk-Maxwell was in the habit of recreating his mind from its severer task by penning amusing physio-comic parodies of well known poems. One of the best of these was his electric valentine, which runs as follows:

ELECTRIC VALENTINE.

Telegraph Clerk A to Telegraph Clerk B.

"The tendrils of my soul are twined
With thine, though many a mile apart;
And thine in close-coiled circuits wind
Around the magnet of my heart.

"Constant as Daniell, strong as Grove;
Seething through all its depths, like Smee;
My heart pours forth its tide of love,
And all its circuits close in thee.

"O tell me, when along the line
From my full heart the message flows,
What currents are induced in thine?
One click from thee will end my woes."

Through many an Ohm the Weber flew
And clicked this answer back to me:
"*I am thy Farad staunch and true
Charged to a Volt with love for thee.*"

$\frac{dp}{dt}$.

The inscrutable signature, $\frac{dp}{dt}$, is explained by a correspondent in *Engineering* to be adopted from the fundamental equation of thermodynamics $\frac{dp}{dt}$ = J. C. M. (James Clerk-Maxwell.

The First Year of the New York Elevated Railroads.

The report of the New York Elevated Railroad for the year ending with September last covers the first year during which the whole length of the road was operated, that is, about 8¼ miles from the battery to Harlem, and 5 miles from the battery to Fifty-ninth street. In that year 29,875,912 passengers were carried, and the earnings from passengers (all the other earnings were but $4,546) were $2,233,402, an average of 7.48 cents per passenger, and about $165,540 per mile of road. The expenses of operation were $1,171,339 for "operating the road," which in the New York schedule includes all working expenses except maintenance of road and maintenance of equipment. Under these latter heads only $51,459 was expended on road and $74,458 on rolling stock—thus bearing an extremely low proportion to the other working expenses. As this was the first year of operation for most of the road, these maintenance expenses were probably lower than they will be on the average hereafter. They will doubtless always be a smaller proportion

of the total expenses than on ordinary railroads, at least for maintenance of road, because the train movement is extraordinarily great, the trains exceptionally light, and the road exceptionally durable and permanent—no ballasting to keep up, ties uninjured by bad drainage, no liability to floods, only the rails wearing out about as on other roads in proportion to the tonnage passing over them. The average *expense* per passenger carried was not quite 4 cents (3·92 cents). If a uniform fare of 5 cents had been charged at all hours, which has been strongly advocated by some of the city papers, the net profits (with the same traffic) would have been reduced from $1,068,150 to $322,660, or to little more than two thirds of the interest on the bonds. Doubtless a 5 cent fare in the middle of the day would increase the traffic considerable, but certainly not enough to make up the difference in the rate. To do that it would be necessary for the number of passengers to become more than three times as great. As the road already carries at 5 cents during the four hours when traffic always is heaviest, and when the greatest bulk of the necessary travel must be done, there would be no possibility of any such increase; but this does not prove that some modification in rates, which would fill the trains when they now run more than half empty, might not prove profitable. It now costs as much to travel a quarter of a mile on this road as to ride the 8½ miles from the battery to Harlem. On the Third avenue line, which passes through a densely peopled district where most of the residents are not very rich and many are very poor, and which passes close to some of the leading retail centers, most people would rather pay 5 cents to ride a mile, many to ride two miles, and not a few to ride three miles, on the street cars, than pay 10 cents on the elevated road. But it would not by any means be an easy matter to provide for the collection of different rates for different distances on this road.

The enormous net earnings of $79,122 per mile were all absorbed except $28,690 by the payments of interest, the 10 per cent dividends on the stock, and a payment of less than $28,000 to the city of New York as a sort of charter tax. The traffic of this road will doubtless increase (at least till the Second avenue line is opened), but it is not at all certain that the expenses will be so low hereafter, now that prices have risen and after the road and rolling stock have had time enough to wear out a little. The cost of the road and equipment is reported at just about $1,000,000 per mile; this is the cost in stock and bonds. The contract for constructing it could be, or could have been, let for cash for less than one half of that amount, doubtless.

The Metropolitan Elevated Railway has also rendered its report for the same year, during the whole of which its line from Trinity Church to Central Park was open, and during three fourths of it the line through Fifty-third street giving access to one additional important station, while later, one after the other, it was opened to three or four other stations, only one of which, however, yielded any considerable amount of traffic during the year in question. It shows for the year a profit of $576,456, while the bonds outstanding at the close of the year require $304,920 for interest, and the 10 per cent dividends on the stock guaranteed by the Manhattan Company will amount to $650,000. This, however, will cover a great deal of road not in operation last year, though it can hardly be expected to be as productive as the old road for some years to come.—*Railroad Gazette.*

Light Draught Fast Steamers.

The following particulars are given by a correspondent of the *American Ship:* Although there are many points of construction which might be adopted from Eastern steamers with advantage, on the shallow and dangerous rivers of the Mississippi Valley, it is doubtful whether their hull models could be studied with profit. Nearly all the steamers navigating the Mississippi and its tributaries are constructed upon the Ohio. The perfection the builders along that river have attained in constructing vessels of exceedingly light draught may be inferred when we state that, on any day during the navigation season, steamers, having a freight capacity of from 1,000 to 1,800 tons, may be seen at the Cincinnati wharves, which draw less than three feet light. And there are many boats plying the Upper Ohio which trim on two feet, to say nothing of the little low water "dinkies," which can almost "navigate a meadow after a heavy dew."

The Telegraph, a large passenger boat, 288 feet in length, 41 feet beam, and 6 feet hold, draws light, two feet.

The Golden Crown, a fine stern-wheel steamer of the Southern Transportation Line, running between Cincinnati and New Orleans, has a capacity for over 1,500 tons of freight, and trims, with steam up, *two feet water.*

The Mary Houston, of the same line, side-wheel, draws less than three feet, and carries 1,500 tons.

The Guiding Star, also of the S. T. Line, is over 300 feet in length, and has a capacity for 1,800 tons. She draws 33 inches, light.

The New Natchez, one of the fastest of the big palatial steamers on the Lower Mississippi, is 303 feet long, 46 feet beam, and 10 feet hold She has 8 steel boilers 36 feet long, 43 inches diameter. Engines, 10 feet stroke, 34 inches diameter; capacity for 2,000 tons freight or 8,000 bales cotton; draws light, less than 5 feet.

The St. Lawrence, an elegant and swift Ohio river side-wheeler, is 270 feet long, carries 1,000 tons, and *draws twenty-seven inches.* The Pittsburg, stern-wheel, carries over 1,000 tons, and draws only 24 inches.

Many other steamers of equally remarkable draught could be enumerated had I the space. Many of the small stern-wheelers, navigating the bayous and small tributaries of the Mississippi, draw less than 14 inches, and yet have room for 1,200 or 1,400 bales of cotton. The most necessary improvement in Western steamers, and especially in the boats plying in long distance trades, is an increase of speed. With the exception of a few of the fast palaces on the Lower Mississippi, there are few boats that ever attain 15 miles an hour up stream, and 12 miles an hour is considered extraordinary. Such slow time is unpardonable in an age of rapid transit like this, and, as long as Western river boats continue to disregard the demands of commerce, railways will hold the upper hand in competition.

Kroh's Rapid Process.

The formulæ for Herr Kroh's rapid plates is given as follows in the *Photographisches Wochenblatt:*

To one kilogramme of iodide collodion add a quarter of an ounce (= 8·75 grammes) of the following solution: Absolute alcohol seventy grammes, and three to four grammes of isinglass or gelatine cut small and dissolved by heat in a glass containing thirty-five grammes of distilled water; then add four grammes of iodine of potassium and three grammes of bromide of ammonium, and when all is completely dissolved and filtered through a piece of linen previously thoroughly washed in alcohol, pour into a bottle capable of holding about a kilogramme and a half. To a quarter of an ounce (= 8·75 grammes) of the above solution add one kilogramme of iodide collodion and shake thoroughly for eight or ten minutes; then add from eight to ten drops of acetic ether, and the result will be the so-called "cheesy collodion."

Remarks on the Foregoing.—On the addition of the gelatine and iodine solution there is an immediate, though harmless, appearance of turbidity, and by this addition cotton is precipitated, but may be redissolved by diligent shaking. The iodizer—that is, the gelatine iodizing solution—may be varied according to the state of the light and the position of the studio. If powerful pictures are desired the following should be used:

Iodide of ammonium	4	grammes,
Bromide of cadmium	4	"
Absolute alcohol	70	"
Distilled water	175	"

If it be desired to work without intensification, and to have an extremely sensitive collodion, then take:

Iodide of sodium	4·50	grammes,
Iodide of lithium	6	"
Absolute alcohol	70	"
Distilled water	26·25	"

If the collodion be required to work rapidly, but not powerfully, then to one kilogramme of prepared collodion add 0·78 gramme of sublimed iodine. It is as well when pouring off superfluous collodion to let it run into a second bottle. Allow the plate to become *perfectly* dry before dipping it into the silver bath.

The development is effected by two developers, Nos. 1 and 2:

DEVELOPER NO. 1.

Distilled water	60 ounces	=	2·1 kilogrammes.
Ferrous sulphate	3 "	=	105 grammes.
Acetic acid	3 "	=	105 "
Absolute alcohol	4 "	=	140 "

RAPID DEVELOPER NO. 2.

Distilled water	60 ounces	=	2·1 kilogrammes.
Ferrous sulphate	5 "	=	175 grammes.
Acetic acid	3 "	=	105 "
Absolute alcohol	4 "	=	140 "
Oxalic acid	4 to 5 grains	=	0·36 gramme.

Developer No. 1 is applied cold. The rapid developer requires that the ferrous sulphate, the water, and the oxalic acid should be heated and properly dissolved in a shallow vessel; when the solution has become cold the alcohol and acetic acid are added, and then the whole is filtered. After the exposure the plate is coated with developer No. 1; when the highest lights have been brought out it is poured off, and then the rapid developer is taken, which immediately brings out the deepest shadows. If soft pictures for intensification be required then the rapid developer should remain a long time upon the plate, and a short time in the reverse case.

FIXING BATH.

Water	10 parts.
Cyanide of potassium	1 part.

INTENSIFIER.

Silver	17·5	grammes.
Distilled water 1 kilo.	35	"
Chemically-pure nitric acid	8	drops.
Pyrogallic acid	2·75	grammes.
Citric acid	1·46	gramme.
Water	560	grammes.
Glacial acetic acid	17·5	"

After drying the plates, which are not sufficiently powerful, are varnished with common varnish, and then strengthened with the above intensifier. If the plates are blue after being well washed they are coated with a solution of 5·5 grammes of cyanide of potassium in 350 grammes of water, to which from five to eight drops of the intensifying silver have been added (and well shaken) until the surface becomes a bright yellow.

SILVER BATH.

60 grammes of iodide of potassium dissolved in 70 grammes water,
25 " " nitrate of silver " " 620 " "
8 to 10 drops of the iodizing solution given above.
2 drops of nitric acid.

The bath may be used the second day. The photographer is recommended to prepare three silver baths, and to use a different one every day for three days and then recommence, so that each bath is only used one day in three. In studios where from twenty to thirty sittings are given daily six baths will be required. Time of floating, three minutes. The duration of the exposure should, with a good light, be three-quarters less, and with a bad light a half less, than by other processes.

The Erie Canal.

In a recent letter to the New York *Tribune* urging the deepening of Erie Canal, Mr. T. C. Ruggles says:

The reasons why steam has not succeeded better on the canal are, first, the steamer was not long enough; it required either more length itself or another boat to push; and next, the bottom of the canal was not finished to its proper width of fifty-six feet, and to a depth of seven feet for this width at the bottom, so that two loaded boats could easily pass each other. The only way to do on the canals, as the locks would not admit longer boats than those now in use, was to fasten one boat before the other, taking them apart at the locks. This, in fact, has doubled the capacity of the steamer, and enabled the same crew to bring down twice the load for the same price, and has made steam a success. The State Engineer, the Hon. Horatio Seymour, Jr., recommends deepening the canal one more foot; but eight feet deep, though a great aid, will make but little difference in the cost of transportation (about one quarter of a cent a bushel), and no difference in time. If steamer and consort are each to be loaded forty more tons, they will be so deep in the water that there will be but a few inches between the propeller wheel and the bottom of the canal; consequently the steamer and consort will not go over two and half miles per hour, or be eight days from Buffalo to New York. Three feet deeper, with the canal banks raised one foot, will reduce the time to New York to four and one quarter days, instead of eight, and the cost of moving a bushel to one and three quarter cents.

The cost of deepening the canal one foot is estimated by Mr. Seymour at $1,100,000. From 1868 to 1876 the canal reduced the tolls from six cents a bushel to two cents, but made no improvements in reducing the cost of transportation. The New York Central in the same time was constantly improving its means of transportation. In 1875 and 1876 this road expended $3,849,270 for depots, engines, superstructures, etc., for the purpose of expediting and cheapening its transportation. The following is the comparative result of the canal and railroad policy:

In 1868 the canal moved tons one mile	1,066,751,968
In 1876 the canal moved tons one mile	570,959,064
Loss	492,792,904
In 1868 the railroads moved	366,190,786
In 1876 the railroads moved	1,674,467,055
Gain	1,308,247,269

The canal lost in eight years nearly half its tonnage, while the railroad in eight years nearly quadrupled its tonnage.

The White Wax of Sze-chuen.

Describing some curiosities of trade in China, the *Pall Mall Gazette* gives a number of interesting facts with regard to the production of the white wax of Sze-chuen.

In the Keen-chang districts of that province there grows in abundance the *Ligustrum lucidum*, an evergreen tree with pointed ovate leaves, on the twigs of which myriads of insects spread themselves like a brownish film, in the spring of each year. Presently the surface of the twigs becomes incrusted with a white waxy substance secreted by the insects, and it increases in quantity until the latter part of August, when the twigs are cut off and boiled in water. During this process the wax rising to the surface is skimmed off, and is then melted and allowed to cool in deep pans. By one of those curious accidents which have done so much to increase the knowledge of mankind, it was discovered that by transporting the insects bred in Keen-chang to the less congenial climate of Kea-ting Fu, in the north of the province, the amount of wax produced was vastly increased. No people more readily discern a commercial advantage, or more speedily take advantage of one when unencumbered with political considerations, than the Chinese; and this singular effect of removing the insects from a congenial climate to one so uncongenial as to prevent their breeding was eagerly taken advantage of by the Sze-chuen traders. Travelers by night on the high road between Keen-chang and Kea-ting Fu may meet in the spring of the year hundreds of wax merchants, each carrying his load of female insects, big with young, on their way to the wax farms in Kea-ting Fu. The journey is rough and long and a fortnight's sun would precipitate the hatching, which should take place after the females have been attached to the trees. To the unscientific eyes of Chinamen the round pea like female appears to be nothing more than an egg, and this belief is the more excusable since the birth of the young is the signal for the death of the parent, of whose previous existence there remains only as evidence an outer shell or husk. Six or seven of these prolific mothers are wrapped in a palm leaf and tied to a branch of the *Ligustrum lucidum*. In a few days swarms of infinitesimally small insects creep forth and cluster on the twigs of the tree, where they fulfill their mission and perish with its accomplishment in the boiling pot each August. Baron Richthofen considers the value of the annual crop to be on an average upwards of $3,000,000; and during last year there was exported from the one port of Hankow upwards of $400,000 worth of it.

NEW INVENTION.

Mr. John Rogers, of Eldridge, Iowa, has patented an improved harrow, in which the frame is made in two parts, an upper and a lower, connected together and fitted to move lengthwise upon each other. The teeth are pivoted upon the upper frame, and pass through apertures in the under frame, so that the inclination of the teeth is dependent upon the relative position of the two parts of the harrow.

Business and Personal.

NEW BOOKS AND PUBLICATIONS.

CONTRIBUTIONS FROM THE E. M. MUSEUM OF GEOLOGY AND ARCHÆOLOGY OF PRINCETON COLLEGE. No. 2. Topographic, Hypsometric, and Meteorologic Report. By William Libbey, Junior, and W. W. McDonald, of the Princeton Scientific Expedition of 1877.

With these reports are three maps: the first containing the results of a topographical reconnoissance of the valley of Smith's Fork, in the Uintah mountains of Utah; the second containing the triangulation of the same region; the third showing the country between Fort Bridger and the Uintah mountains. The meteorological and topographical work was confined mostly to this region. The only work of scientific value done in Colorado was hypsometric. The report is embellished by a number of admirable artotype prints from photographs of typical scenery in Colorado and Utah. For students' work the entire report is decidedly creditable, and speaks well for the instruction given in the college.

DICTIONARY OF COMMERCE AND MANUFACTURES. By L. de Colange, LL.D. Boston: Estes & Lauriat. 1 vol. quarto, pp. 1,200. Published in 25 parts. Each 50 cents.

The first four parts of this dictionary (A1 to Cologne Water) cover a wide range of subjects, and contain much useful information. The compiler, however, does not seem to have had access to the latest information in all cases; and too frequently his definitions show haste or carelessness in their wording. The illustrations also are for the most part rather ancient and not always such as to justify their insertion in a work of this nature.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

---

(1) C. T. W. asks: 1. Can paper be subjected to any chemical process so as to change color by the impact of any hard substance, and thus give impressions of coins or seals without the intervention of ink or coloring matter? A. As we understand you, no. 2. Has any successful attempt ever been made to obtain lithographic copies of the original writing or drawing without transferring to the stone, by the use of artificially prepared paper? A. Your question is rather ambiguous. There are several autolithographic and photolithographic processes in successful use. Consult the back numbers of the SCIENTIFIC AMERICAN and the records of the Patent Office. 3. Is there any prepared oil or varnish by which paper can be rendered impervious to water and still be capable of receiving ink, so as to, in a measure, take the place of the lithographic stone? A. We believe no practical success has been achieved in this direction.

(2) C. writes: A serious fire just took place in a large hotel heated by steam and having electric bells, annunciators, etc. In the room where fire originated between the flooring, a large bunch of bell wires run, also steam and gas pipes, chimney in room also. The proprietors claim there has been a gas leak in room, under flooring, a long time. During the afternoon the bell indicating that room rung at intervals from some unknown cause (fire occurred in evening). The general belief is, that fire originated from spark of two wires coming in contact (insulation eaten off) igniting the escaping gas. Now, is it possible for such a contingency, with only four Leclanché batteries in circuit? Isn't it more probable fire took from steam pipes coming in contact with woodwork? A short circuit from some batteries, even from 12 elements, would not light gas at a burner without an induction coil by experiment. A. It rarely happens that a fire is caused by the contact of steam pipes with woodwork. When it does occur it is generally traceable to some highly inflammable substance accumulated around the pipe. If there was a considerable gas leak the fire might have been communicated from the chimney, or from a distant gas flame. It is also quite possible that it might have been ignited by an electric spark, if the wires could have been brought into contact by any means. In your experiment you seem to have forgotten that the helices of an electro-magnet are really induction coils from which a spark may be obtained with small battery power whenever the circuit is broken.

(3) G. F. W. asks: What material will mix with an oil filling for wood, and stain the wood black or nearly so? A. Boettger recommends the use of the vegetable fuel contained in the anacardium nut in this connection. The oily matters are obtained from the crushed nuts by means of petroleum spirit or bisulphide of carbon.

(4) S. W. F. writes: I am having made a spiral vane as described in your reference book. The spiral is made of thin sheet copper, such as tinners use for boilers, etc. Can I cement the mica or small pieces of looking glass to the spiral so that it will stand the weather and stay on? A. Melt together in an iron pan over a moderate fire pitch and gutta percha, in about equal parts, and add to the mixture about 20 per cent of shellac. Use hot, warming the parts to be joined, and avoiding the use of too much cement in the joint.

(5) E. R. asks how to make a small induction coil such as is used with the Blake transmitter. A. Make a thin wooden spool 3 inches long, ⅜ inch internal diameter. Fill the hole through the spool with a bundle of No. 20 iron wires well straightened. Wind on the spool 4 layers of No. 40 silk covered copper wire. This is the primary wire, which is connected with the battery and transmitter. Cover the primary coil with paraffine paper, and wind on it six or eight courses of No. 38 or No. 40 silk covered copper wire. The ends of this coil are connected with the line which includes the receiving telephones.

(6) A. E.—Phosphor-bronze contains 90 to 91 per cent of copper and 9 to 10 per cent of tin. The proportion of phosphorus added is about ½ of one per cent. The phosphorus imparts greater fluidity to the metal in the crucible and greater strength and elasticity, etc., to the castings.

(7) W. N. W. writes: 1. In "Hints to the Young Steam Fitter," page 385, third column near bottom—S. A., December 6—the writer says: "But the maximum pressure of steam to be carried must never exceed the equivalent of a difference in level of water between the water line of the boiler and the lowest part of the distributing main." I would like to ask him why, and what difference it can make whether you carry one pound of steam or three? A. Mr. Baldwin has furnished us with the following: The words mentioned apply to low pressure gravity apparatus, as they usually exist, the distributing mains being of size barely sufficient to expel the air from the radiators furthest from the boiler, when a mercury column or good low-pressure steam gauge will often show 2 or 3 lb. at the boiler. Thus at the part of the distributing main furthest from the boiler, we will say a gauge will show ½ lb. pressure and at the boiler 3 lb., the reason of the difference is, we are dealing with an elastic and condensable fluid, of tension so low that its velocity is not great enough to keep a nearly initial pressure throughout the system above the water. Now, again, put a gauge on the boiler at the water line, and it will show 3 lb. pressure also. Again, tap into the return relief at the same level, and it will show 3 lb. Why? because we are dealing with a fluid that has no practical elasticity and will raise in a pipe 2¼ feet (very nearly) for every pound of difference between terminal and initial pressures, and this head of water will rise into the main unless it is high enough above it. I wish also to call inquirers' attention to page 336, No. 22, S. A., where it says: "To have the water of condensation return directly into the boiler under all conditions and pressures, the main pipes must be large enough to maintain the pressure of the boiler to within 1 or 1½ lb. in every part of the apparatus." 2. I would also like to ask him to make a little plainer his rule for calculating size for steam mains. A. The areas of the cross section of pipes are to each other as the squares of their diameters. Thus if the size of a one inch pipe in the main at the boiler is enough for 100 square feet of heating surface, a 4 inch pipe will do for 1,600 square feet. Thus square of 1 = 1. Square 4 = 16 ÷ 1 = 16 hundred square feet, or if you have the heating surface, and want to find the size of main, take 1-10 (one tenth) the square root of the heating surface in feet, and it gives the diameter of the pipe in inches.

(8) W. H. writes: I have a steam job to do in a store. Two of the radiators are forty feet from the boiler, and there is no cellar underneath for that distance. The joist lay on the ground. I have taken out a trench and placed my pipes in it, and made it ten inches lower at the connection on the main distributing pipe than that at the radiators, and run the return the same way. So you see the water in the supply pipe running against the steam. I do not see any other way to do. Am I right? A. If the distributing main is ample, and the pipe in trench large enough, it will answer; but should these two radiators give trouble and act differently from the other radiators in the job, take their steam pipe directly to the boiler.

(9) C. C. asks: 1. Why does a ball rise above the direction in which it is shot from a gun? A. We think this could not happen with a rifle, and it would not be likely to occur with a smooth bore, except with an imperfect ball. 2. When a balloon is above all obstructions, and has no other motor than the wind, will it go faster than the wind that moves it? A. No. 3. If we run a locomotive on a level road, two miles in two minutes, will there not be more friction than if we run it one mile in two minutes? A. In the aggregate for time, yes; for distance, no.

(10) H. N. asks: 1. Has a locomotive with low drive wheels more power of traction than it would have if the circumference of the wheels were larger? If so, why? A. Yes, other things being equal, because the pressure on the piston has greater leverage on the point of resistance, the radius of the wheel. 2. Of what particular use is the vacuum to the marine or condensing engine? A. To remove the pressure of the atmosphere from behind the piston.

(11) W. S. W. writes: I have a well, 7 feet in diameter: shall I, by multiplying 3·1416 × 7, get the circumference of the well? A. Multiply 3·1416 by the diameter, the product is the circumference. 2. What will I divide by to find out how many cubic feet in 1 foot? A. To get the contents multiply the diameter by 0·7854, and the product by the length of the column—all in inches—the final result is cubic inches. You should study some good elementary work on mechanics.

(12) C. H. B. writes: In your issue of September 27, page 204 (No. 24), you say that a 4 inch solid pillar will support more weight than a 6 inch hollow pillar. A. Your former question was simply whether a solid or hollow pillar of a given diameter would carry the greatest load; the answer was correct. 2. Now, suppose two pillars to contain the same amount of material, one being cast solid, the other hollow, which will sustain the greatest weight? A. The hollow pillar will be the strongest in this case, and the larger the diameter the better, so long as the thickness is sufficient to insure sound castings.

(13) E. J. asks: 1. What is caking coal? A. Soft bituminous coal that cakes in a fire. 2. How are Hessian crucibles made? A. See p. 267 (4), Vol. 29, of SCIENTIFIC AMERICAN, for the details of crucible making. 3. How many feet in one pound No. 16 copper wire? A. About 80 feet, by Birmingham W. G., and 127 feet, by American W. G.

(14) F. D. writes: I have a telegraph line about a mile in length running into my room. The ground connection is made by means of the gas pipe. The wire used inside of the house is all insulated, and the line wire is one or two sizes smaller than is usually used. I have 3 jars of gravity battery. Is there any danger from lightning? A. If you use a lightning arrester and connect your ground wire with the gas pipe outside of the meter there is no danger.

(15) O. E. P. writes: Referring to "Notes and Queries" in SCIENTIFIC AMERICAN, p. 417 (30), last volume, A. C. says he can't dissolve bleached shellac in alcohol for varnish; you suggest that he has not pure alcohol. I have had considerable trouble with making varnish from bleached shellac, and I find there is more likely to be trouble from adulterated shellac than poor alcohol. In this city (Richmond, Va.), it is impossible to get bleached shellac which has less than 30 per cent of adulteration. With 95 per cent alcohol the varnish made with this will be curdy in the middle, alcoholic solution at the top, and a dirty whitish powder at the bottom. I would suggest that A. C. try some other shellac, and bruise in small pieces before adding the alcohol, and set it where it will be warm, say 70° Fah. If the shellac and alcohol are both good, he ought to have his varnish ready for use in from 24 to 36 hours.

(16) W. J. says that wood sawing is rendered much easier by occasionally oiling the saw with kerosene.

(17) J. E. B. asks: How much horse power can be obtained from a stream of water 40 feet head flowing through a 4 inch pipe and employing a common turbine wheel? A. Allowing for friction, etc., from 1½ to 2 horse power.

(18) F. P. asks what length and diameter of screw would be required to propel a sharp built boat of twenty feet. A. 20 inch diameter, 30 to 32 inch pitch, and 5 to 6 inches length.

(19) D. M. asks: Can stone houses be built in any way to be free from dampness? A. If the walls are properly furred and the spaces between the furring and the wall are ventilated, dampness may be avoided.

(20) J. A. B. asks whether emery or corundum wheels or stone can be used for the expeditious grinding of round bottles into shape for sulphide of carbon prisms. A. Use square bottles, grind them upon the flat side of an iron disk supplied with fine sharp sand and water.

(21) S. J. M. asks for a reliable method of cleaning kid gloves. A. Put them together with a sufficient quantity of pure benzine in a large stoppered vessel, and shake the whole occasionally with alternate rest. If on removing the gloves there remain any spots, rub them out with a soft cloth moistened with ether or benzole. Dry the gloves by exposure to the air, and then place smoothly between glass plates at the temperature of boiling water until the last traces of benzine are expelled. They may then be folded and pressed between paper with a warm iron. Another way is to use a strong solution of pure soap in hot milk beaten up with the yolk of one egg to a pint of the solution. Put the glove on the hand and rub it gently with the paste, to which a little ether may be added, then carefully lay by to dry. White gloves are not discolored by this treatment, and the leather will be made thereby clean and soft as when new.

(22) M. W. asks: How can I cement parchment so that it will stand both hot and cold water? A. Mix ordinary glue with about 3 per cent of potassium or ammonium dichromate in the dark. This may be used on the paper, and after exposure to light becomes perfectly insoluble in boiling water. This glue has been very largely used in Germany for joining the parchment paper envelopes of pea sausages. The strips of paper joined by this glue are dried quickly and exposed to light till the glue changes to a brownish color; they are then boiled with water containing about 3 per cent of alum till all the excess of alkaline dichromate is extracted, and then washed in water and dried.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. T. S.—The mineral is marcasite, iron sulphide, in a quartz matrix. It is not indicative of anything valuable.

COMMUNICATIONS RECEIVED.

On Ship Railway. By F. M. O.
On Crystallization of Bodies. By T. W. S.
On the Origin of Coals and Ores. By R. B.
On Ice Boats. By G. M. R.
On Some Pre-Historic Bones. By C. H. S.
On Ice Boats. By H. J. T. and W. B. M.
On Ice Yachts Sailing Faster than the Wind. By F. S. C. and F. K. S.
On Steam Jet Signals. By F. P.
What is Good Silk? By L. L.
On Electrical Generators. By S. W. R.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 9, 1879.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city.

Air heater, J. T. Greenwood ... 222,380
Air heating attachment, J. M. Patterson ... 222,324
Animal trap, C. Marth ... 222,150
Antiseptic and deodorizing compound, M. Burchard ... 222,482
Bag, A. Smith ... 222,125
Bedstead, folding, W. S. Burr ... 222,323
Beer cooler, F. Heller ... 222,465
Beer, manufacture of, E. Kokosinski ... 222,107
Bed, L. Aarons ... 222,434
Belt fastener, C. W. Sager ... 222,345
Belting, machine for making rubber, J. Murphy ... 222,324
Bicycle, E. Sawyer ... 222,137
Blacksmith's tool, L. C. Derry ... 222,420
Blind fastener, window, W. H. H. Allen ... 222,465
Book, copy, J. W. C. Gilman ... 222,349, 222,350
Bridge, B. Hoods ... 222,499
Bridge and turn-table, turn, D. Blanchard ... 222,323
Buggy top, J. H. & K. M. Keller (r) ... 8,980
Burglar alarm, A. J. Ridgeway ... 222,338
Button card, G. P. Farmer ... 222,402
Button or stud, separable, F. P. Barney ... 222,441
Button, separable, A. H. Leodner ... 222,356
Can tops, etc., die for cutting, J. W. Farrell ... 222,401
Car coupling, J. M. Van Why ... 222,351
Car jack, J. J. Hamilton ... 222,402
Car window, W. W. Machall, Jr. ... 222,518
Carpet lining and stair pad, M. Townsend ... 222,370
Carriage brake, baby, W. F. Wallburg ... 222,553
Carriage brake lock, G. E. Clarke ... 222,456
Carriage top prop, H. K. Porter ... 222,370
Cart, dumping, G. B. Wheeling ... 222,557
Caster, furniture, J. H. Schloss ... 222,358
Churn, J. Wolf ... 222,481
Clock, calendar, W. L. Bundy ... 222,377
Clock, electro-magnetic, C. Shepherd ... 222,624
Coal as fuel, utilization of the dust or culm of anthracite, J. L. Crouse ... 222,466
Coal hod, W. Easterbrook ... 222,347
Cock, gauge, H. C. Montgomery ... 222,301
Coffee preparation, H. H. Snow ... 222,477
Collar, horse, B. Palmer ... 222,304
Corset steel fastening, L. Hill ... 222,400
Cotton gin, H. N. Reid ... 222,306
Cotton opener, R. Kitson ... 222,110
Cotton scraper, J. M. Richards ... 222,367
Crib and bedstead, interconvertible, S. S. Burr ... 222,378
Cuffs, box for displaying, S. W. Wilson ... 222,340
Culinary apparatus, R. J. Gatling ... 222,351
Cultivator, H. Bloedel ... 222,446
Cultivator, J. M. Elder ... 222,301
Cultivator, D. Uthank ... 222,550
Cultivator, cotton, R. W. Spencer ... 222,541
Cultivator shovels, repairing, J. Lohr ... 222,312
Cutter head, F. Krein ... 222,310
Damper, automatic hot and cold air, J. W. Crary ... 222,397
Damper regulator for steam boilers, V. H. Hallock ... 222,499
Dish drainer, folding, C. K. Stearns ... 222,542
Disinfectant and deodorizer, R. M. Caffall ... 222,458
Disinfecting apparatus for waterclosets, etc., E. J. Mallett, Jr. ... 222,519
Drawing frame, J. Smith ... 222,540
Dredged material, transporting and delivering, A. B. Hall ... 222,409
Dredging machine, E. Chaquette ... 222,390
Embalming fluid, J. H. & H. B. McCarty ... 222,321
End gate, wagon, W. Alsora ... 222,372
Envelope, sample, T. J. Gorman ... 222,394
Fan, extensible, Havell & Williams ... 222,494
Fare register, J. W. Meaker ... 222,323
Feed water regulator, T. E. Sutton ... 222,462
Fences, barbed top for, W. Osmond ... 222,336
Ferro cyanides, process of and apparatus for making, Tebernise & Gunsburg ... 222,547
Fertilizer distributer, S. H. Everett ... 222,439
Firearm magazine, J. M. Marlin ... 222,413
Folding machine turn sheet, Mendham & Chambers, Jr. ... 222,305
Friction device, C. C. Klein ... 222,304
Furnace grate, H. E. Woods ... 222,432
Furnaces, device for feeding air to, Bartlett & Wilson ... 222,440
Gas burner, P. Pallcott ... 222,619
Gas lighter, electrical, W. H. H. Whiting ... 222,355
Gas motor engine, G. W. Daimler ... 222,467
Gas retort charger, A. Q. Ross ... 222,366
Gas retort discharging apparatus, A. Q. Ross ... 222,364, 222,365
Gas retort discharging machinery, A. Q. Ross ... 222,366
Gate, F. M. Nixon ... 222,361
Grain binder, S. D. Locke (r) ... 8,991
Grain binder, L. J. McCormick ... 222,416
Grain separator, C. E. Merrifield ... 222,300
Grater, nutmeg, C. F. Chase ... 222,454
Grinding machine, L. Seiffert ... 222,359
Hame dressing machine, F. Krein ... 222,306
Harness, M. A. Frost ... 222,495
Harrow, sulky, C. La Dow ... 222,512
Harvester, J. L. Owens ... 222,438
Hats or caps, peak or brim for, O. G. Brady ... 222,448
Hay gathering and cocking machine, Smith & Davis ... 222,436
Hay rake, horse, W. P. & C. E. Clark ... 222,392
Heel burnishing machine, T. L. Kelf ... 222,409
Hoe tooth, horse or hand, D. W. Hughes ... 222,400
Hoop, J. Naylor, Jr. ... 222,305
Horn cutting machine, G. M. Cruickshank ... 222,341
Horseshoe nails, manufacture of, W. W. Miner ... 222,417
Hydraulic press, J. Watson ... 222,004
Indicator form for displaying articles, T. J. & D. J. Braun ... 222,311
Injector for steam boilers, L. E. Hogue ... 222,407
Insecticide compound, Lyons & Ziegler ... 222,118
Iron, fluxing compound for making, J. Tate ... 222,300
Ironware, manufacture of enameled cast, E. C. Quinby ... 222,422
Knitting machine, M. Hitchcock ... 222,431
Lacing hook, J. Briggs ... 222,449
Lamp, electric, R. A. Kipling ... 222,502
Lamp globe base, R. Blackman (r) ... 8,980
Lamp, street, E. Boesch (r) ... 8,993
Lantern, signal, T. S. Easterbrook ... 222,471
Last and standard, W. H. Lounsbury ... 222,316
Leather creasing machine, C. J. Cooper ... 222,396
Loom for weaving pile fabrics, J. C. Ellison ... 222,477
Macaroni, preparing and canning, J. H. Irwin ... 222,408
Millstone dressing machine, T. P. Benton ... 222,443
Millstone driver, W. Johnson ... 222,301
Mines, machine for raising tailings in, E. Chaquette ... 222,391
Mower, lawn, Hartmann & Braun ... 222,400
Nut lock, J. Lee ... 222,517
Oatmeal machine, L. G. Thorp ... 222,348
Ore separator, J. J. Peyton ... 222,320
Oven shelf, automatic, D. G. Littlefield ... 222,352
Packing, metallic, R. Dolp ... 222,396
Paper bag machine, W. C. Cross ... 222,464, 222,465
Paper bag machine, E. B. Stocking ... 222,514
Paper machinery, felt for, E. B. Hayden ... 222,356
Paper, manufacturing, C. T. Tomkins ... 222,630
Pessary, D. Diller ... 222,471
Petroleum oils, refining, E. C. Kattell ... 222,408
Pipe wrench, D. P. Foster ... 222,404
Pitcher, H. Berry ... 222,444
Planter and roller, corn and seed, A. Sutton ... 222,346
Planter, corn, G. W. Bevis ... 222,445
Planter, corn, B. M. Pulliam ... 222,421
Planter, cotton and seed, E. B. Loyless ... 222,517
Plaster's mould, C. Kleinschmidt ... 222,305
Plow, wheel, T. L. Stacy ... 222,344
Printing and folding machine, Chambers, Jr. & Mendham ... 222,455
Pruning implement, J. W. Cogswell ... 222,304
Puddling furnace, revolving, T. R. Crampton ... 222,461
Pump, W. S. Bland ... 222,371
Pumps, operating, Moore & Hickle ... 222,414
Rail, compound, W. J. Holman ... 222,498
Railway signal, W. K. Badger ... 222,436
Railway signal, electric, J. J. Conklin, Jr. ... 222,390
Refrigerating liquids, apparatus for, Young & Neilson ... 222,436
Refrigerator, W. Dreusike ... 222,473
Rein, elastic driving, B. A. Davis ... 222,404
Rein holder, S. J. Woolfy ... 222,369
Rein loops, swivel for bridle, J. B. Hampton ... 222,420
Roads and tracks, machine for leveling and sweeping, A. H. Noorn ... 222,362
Rocker for furniture, platform, A. Rustahol ... 222,306
Rolling mill, R. M. Bassett ... 222,372
Roofing compound, U. Baker ... 222,437
Rotary engine and pump, S. D. & J. Barrow ... 222,439
Rubber goods, apparatus for and method of seaming, W. S. Carr ... 222,345
Sad iron, C. P. Y. La Roche ... 222,306
Saddletree, E. B. Light ... 222,514
Safe, F. Stockwell ... 222,428
Saw guide, circular, E. M. Guernsey ... 222,306
Saw sharpening machine, W. L. Covel ... 222,386
Scoop, hop, N. E. Hinds ... 222,406
Seat or bench, R. W. How ... 222,400
Sewing machine button hole attachment, R. H. St. John ... 222,341
Share and point, combined, J. Killefer ... 222,302
Sheep protector, J. R. Speer ... 222,326
Ship hatches, fastening for, A. Johnson ... 222,407
Slop jar, E. B. Jewett ... 222,406
Snap hook, J. B. Hampton ... 222,491
Soldering sheet metal cans, machine for, J. W. Farrell ... 222,400
Sower, seed, B. T. Genthner ... 222,348
Spoon, medicine, B. T. Trueblood ... 222,349
Square and bevel, combined, J. D. Hobbs ... 222,304
Stamp mill, H. Ahlborn ... 222,371
Starch clearing, etc., woven fabrics, process and machinery for, J. E. Palmer ... 222,337
Steam and other boilers, S. Thacker ... 222,429
Steam boiler, Brown & Seymour ... 222,430
Steam boiler covering, T. Merriam (r) ... 8,994
Steamer, feed, G. R. & M. M. Loomis ... 222,356
Steering apparatus, vessel, A. Johnson ... 222,406
Stirrup pad, saddle, R. E. Whitman ... 222,596
Stone, artificial, Roedler & Marast ... 222,302
Stove grate, W. Phipps ... 222,365
Street sweeping apparatus, E. C. Bowne ... 222,447
Stud for boots and shoes, lacing, A. Dawes (r) ... 8,992
Sugar, coloring, O. H. Krause ... 222,318
Sulky, trotting, Williams & Brown ... 222,556
Telephone, A. K. Eaton ... 222,475
Telephone, carbon, T. A. Edison ... 222,390
Telephone exchange, automatic, Connolly & McTighe ... 222,458
Telephonic circuit, A. K. Eaton ... 222,476
Thermometer, L. Peroni ... 222,420
Thill coupling, J. O. Flower ... 222,381
Thrashing machine, flax, J. W. Crooks ... 222,462
Tile gate, P. M. Earle ... 222,393
Tire shrinker, Stroud & Shuman ... 222,345
Tire upsetting device, E. Depue ... 222,469
Tobacco, treating, C. S. Philips ... 222,340
Toggle presses, driving gear for, F. W. & W. J. Crossley ... 222,463
Truck, E. J. Leyburn ... 222,412
Trunk lock, G. V. Lane ... 222,310
Urn, coffee, E. H. Hawley ... 222,402
Uterine support, galvanic, O. E. Herrick ... 222,300
Valve for steam engines, expansion, A. Brettenuana ... 222,376
Valve gear, steam engine, C. W. Copeland ... 222,450
Vehicle bows and shafts, cover for, H. J. Warden ... 222,558
Vehicle shifting rail, T. H. Graves ... 222,497
Velocipede, A. Knelp ... 222,308
Wagon, dumping, W. Evans ... 222,398
Wagon rack, J. McCallum ... 222,411
Wagon, steam road, O. C. Harris ... 222,353
Wagon tail board catch, H. Havens ... 222,397
Washboard, J. T. Sargent ... 222,536
Wash boiler fountain, W. Barton ... 222,442
Washing and beating skeins or hanks, machine for, G. Moriot ... 222,323
Washing and wringing machine, combined, T. J. Baldwin ... 222,439
Washing machine, D. H. Dorsey ... 222,472
Watches, dial attachment for stem winding, C. P. Collins ... 222,460
Waterwheel, current, J. J. Collins ... 222,457
Wind engine, S. Lane ... 222,411
Windwheel, Loneyear & Clark ... 222,315
Wire twisting machine, J. Gobbels ... 222,488
Wires, machine for beveling and truing, L. K. Forrester ... 222,483
Wool washing machines, roll for, F. G. Sargent ... 222,426

DESIGNS.

Organ case, J. H. White ... 11,526
Printing types, Pettit & Buss ... 11,526
Toy holder for fireworks, E. R. Ives ... 11,521

English Patents Issued to Americans.

December 1 to December 5, 1879, inclusive.

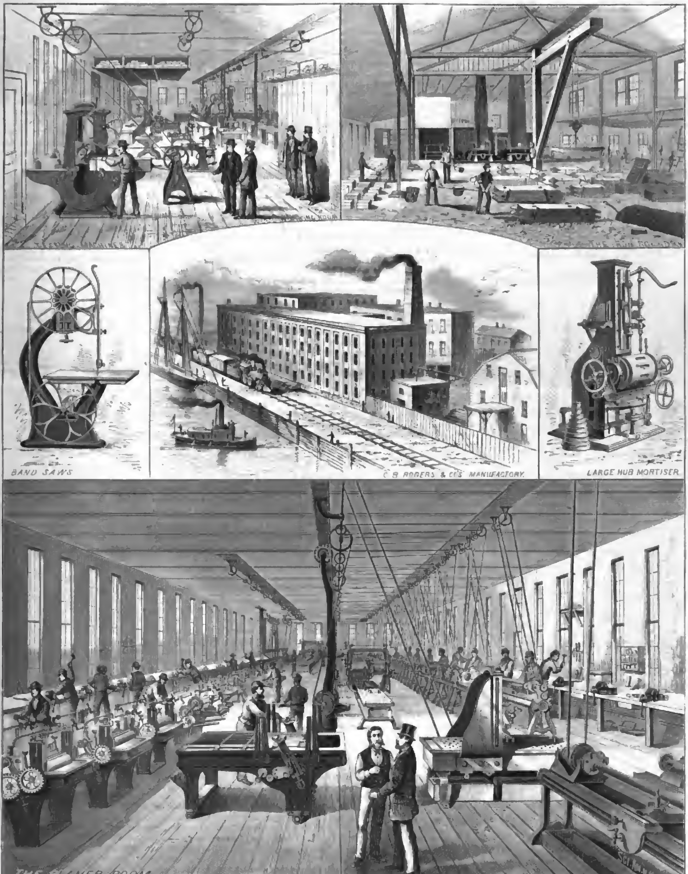
Button hole machine, T. & L. Howard, United States.
Carpet sweeper, H. E. Judd, New York city.
Electric signal for railroads, J. J. Conklin, Jr., N. Y. city.
Electromotograph, J. F. Bailey, New York city.
Food, farinaceous, M. D. Lord et al., New York city.
Harvester, F. Wood, Albany, N. Y.
Journals and bearings, J. R. McLean, St. Louis, Mo.
Measures, liquid, J. M. Thayer, Randolph, Mass.
Paper for checks, etc., and ink therefor, H. M. Walker et al., New York city.
Paper folding machine, R. M. Hoe et al., N. Y. city.
Sewing machines, G. Juengel, New York city.
Shovel for hop kilns, N. E. Hinds, Cooperstown, N. Y.
Stench trap, T. G. Knight, New York city.
Telephones, J. F. Bailey, New York city.
Telephonic communications, R. G. Brown et al., N. Y. city.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 3. [NEW SERIES.] NEW YORK, JANUARY 17, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]



THE MANUFACTURE OF WOOD-WORKING MACHINERY.—WORKS OF C. B. ROGERS & CO., NORWICH, CONN.—[See page 37.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.......... $3 20

One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, JANUARY 17, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 211,

For the Week ending January 17, 1880.

Price 10 cents. For sale by all newsdealers.

PATENT LEGISLATORS IN CONGRESS.

Last winter the enemies of inventors and patentees achieved a signal defeat in a general attack upon the patent system. Profiting by that experience, which taught them the futility of attempting by direct assault the destruction of a system so firmly grounded in popular esteem, they have scattered their forces this year for a sort of guerilla warfare, apparently hoping to do indirectly, under the guise of protection to oppressed grangers and the like, the work they failed to do a year ago.

We have before us four bills which prettily illustrate the spirit and the method of the guerilla system. They have been introduced in the House of Representatives by Mr. Baker and Mr. Colerick, of Indiana, and Mr. Converse, of Ohio, and are numbered respectively 2,631, 2,633, 2,913, and 3,049.

Of these Mr. Baker is sponsor for two. The first is designed to regulate the costs of suit in actions to recover damages for the infringement of patents; and provides that in cases where it shall appear that the defendant purchased in good faith and without actual knowledge of infringement, and applied the article to and for his own use and not for sale or for manufacturing a product for sale, if the plaintiff shall not recover a judgment in damages of twenty dollars or over, the court shall adjudge that he pay all the costs of suit, including a reasonable attorney's fee to the defendant; and if the plaintiff shall not recover a judgment in damages of fifty dollars, or over, the court shall adjudge that he pay all the costs of suit.

The propriety of thus punishing the patentee for defending his property rights will be apparent to all who desire to appropriate his property to their own use. The justice of such discrimination in favor of offenders against patent rights solely, however, may fairly be disputed by all the other classes of thieves and plunderers and receivers of stolen property.

Properly named, the bill would be entitled "a bill to facilitate the infringement of patent rights, and to encourage patent litigation." Since a very large portion of all patented articles and processes are intended for individual use, and not for the manufacture of articles for sale, and since damages for individual misappropriation in such cases are apt to be small, the infringer has everything to gain and nothing to lose in standing suit, while the inventor is bound to sue or practically abandon his rights.

But the advantage thus aimed at is not enough to suit Mr. Baker or his employers. Accordingly he hands in another bill to limit the liability of purchasers to actions for damages in cases of infringements. This bill is short enough to quote entire. It provides "that no suit shall be brought or maintained in any court having jurisdiction in patent cases for any alleged infringement of any patented article, device, process, invention, or discovery, where it shall appear that the defendant, or any person through or from whom he derives title thereto, purchased the same in good faith from the manufacturer thereof, or from any person or firm engaged in the open sale or practical application thereof, and applied the same to and for his own use, and not for sale, nor for manufacturing a product for sale."

Mr. Colerick's bill aims at the same point, and provides that purchase in good faith without knowledge that the purchased article was an infringement of any patent shall be a complete defense against action for damages.

In their best aspect these bills are an attempt to make the United States Courts a sort of patent buffer to guard the purchasers of illegal articles, or articles to which the seller has no title, from the natural and proper consequence of their ignorance and folly. The propriety of thus discriminating in favor of one phase of business imbecility and against one particular class of property owners is as little apparent as is the need of it. The proper way for the complaining farmers to protect themselves against patent swindlers is to buy patent rights and alleged patented articles as they do horses and lands and other property, only after making sure that the seller's title is good. If they will take the risk of buying blindly let them abide the issue manfully, and not call upon Congress to throw the consequences of their folly upon the shoulders of rightful owners who have had no part in the fraudulent sale.

But these bills present a much less tolerable aspect. Ostensibly they are put forth to meet a special class of cases in which innocent farmers are said to be the victims of patent sharps. Really, we believe, they are intended to break down the defenses by which inventors are now enabled to guard their constitutional rights under the patent laws; and in case they are passed they certainly will have the effect to destroy absolutely and utterly the value of a large class of patent rights.

For example: A, in Maine, invents and patents a device calculated to lessen the cost or increase the safety of railway construction or operation. The foreman of a railway company's shops in Indiana offers the invention as his own to the company which employs him. They buy it and use it. In course of time the inventor hears of the infringement and brings suit. After such delays and multiplications of court expenses, as powerful corporations are so well able to effect, the case comes to trial and the defendants raise the plea that the purchase was made in good faith, for their own use, and not for sale or for manufacturing a product for sale. The defense is complete; the plaintiff gets no damages, and besides suffering the loss incident to the invasion of his rights he has to pay all the costs of the suit and a "reasonable" fee to the railway company's attorney. An admirable issue, truly, for a patent law designed for the advancement of the useful arts by the encouragement of inventors!

But Messrs. Baker and Colerick are mere bushwhackers compared with Mr. Converse. The latter gentleman enters the lines of the patent defenders, ostensibly in friendship, and quietly drops a match into the magazine, hoping thereby to blow up the entire system. In this way:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That it shall be unlawful for any owner, or part owner, or assignee of the whole or any part of any patent granted or pending under the laws of the United States to charge or receive as royalty on such invention or discovery more than an amount equal to the cost of production, and twenty-five per centum to be added thereto for profits of manufacture in addition to such cost, and twenty-five per centum profit. Whenever the invention or discovery or the article patented, or when patent is applied for, is used for hire instead of being sold, it shall be unlawful to charge or receive for such use more than the royalty, cost, and profit of manufacture aforesaid. *Every owner or part owner, by assignment or otherwise, of any patent heretofore or which may hereafter be granted, or for which application is pending under the laws of the United States, shall forfeit to the public all right to said discovery or invention.*"

That is all; and it is certainly quite enough. At first sight it may seem as though some specific offense should have been named in the final clause. But that is not at all necessary. The act of applying for a patent for an invention is offense enough, in the eyes of men like Mr. Converse and his anti-patent associates, to justify the forfeiture of all right to the invention; and Mr. Converse is to be commended for frankly and boldly stating precisely what the would-be patent law amenders are driving at.

A NEW DEEP SEA SOUNDING APPARATUS.

We have received from the author, Sr. Henrique de Lima e Cunha, a copy of a paper recently read by him before the Lisbon Academy of Sciences on the subject of a new deep sea sounding apparatus devised by him, and which appears to have some valuable features, in addition to possessing the merit of novelty. In taking soundings at great depths, and in places where there are strong undercurrents, no very great exactitude can be attained by ordinary methods, owing to the fact that the line is carried off by the undertow, and the length paid out does not represent the vertical distance to which the weight has descended. The apparatus under consideration is based on the effects of atmospheric pressure. It consists of a cone of sheet copper, having for its base a diaphragm of the same metal, and which screws into the bottom of the cone so that it may be readily removed when necessary. In this movable base there are six small holes, one millimeter in diameter, which allow the ingress of the sea to the interior of the cone; and to the center of its upper surface there is soldered a vertical wire of pure silver, two millimeters in diameter, and which occupies the axis of the cone.

To prepare the apparatus for use the silver wire is moistened with nitric acid, which results in the production of a thin film of nitrate of silver. The base being screwed on, the cone is suspended by means of a ring at its apex, and sunk by means of two separate weights or stones suspended by cords or chains depending from three rings attached to the perimeter of the cone. To insure a vertical position to the apparatus and to prevent it from being easily turned from its course, a small float is attached just above the suspension ring at the apex of the cone. As the apparatus sinks into the sea the water penetrates into it through the orifices in the diaphragm and gradually rises in proportion as the pressure increases during the descent. The salt water acts on the thin coating of nitrate of silver on the wire, and turns it perfectly white by the production of chloride of silver as far as immersion has taken place. By this means, therefore, is determined to what height the water has risen in the cone, and consequently what the pressure has been; and from these data the depth to which the instrument has descended is easily determined by simple formulæ. The author suggests that by suspending the lower weight by means of an apparatus which would detach it on striking bottom, the apparatus would ascend to the surface of itself, thus dispensing with the use of a line.

PROSPECTS OF TRADE IN BRAZIL.

The picture of a sturdy negro carrying a wheelbarrow on his head would not be a bad symbol of the force of custom which, in an infinite variety of ways, labor-saving inventions have to overcome in most parts of the world. Our consul general at Rio Janeiro says in his recent annual report that a negro so employed had lately been seen by him in the streets of that city. The rarity of good roads in tropical countries has led to a general custom of carrying burdens on the head; and even with good wheeling provided the handy wheelbarrow was to the Brazilian porter only so much additional burden.

The overcoming of such deep-rooted and stupidly-followed customs is one of the main tasks to be performed in building up any considerable trade with foreign, more especially tropical countries. For this work the commercial agent and the manufacturer as well needs know by personal study what are the customs of the people he wishes to trade with, how to adapt his wares with the least change to meet their wants, and to avoid sending wares which cannot by any possibility be made available.

In the report referred to Mr. Adamson says that his office is inundated with letters of inquiry, many of them asking

for information which any school geography or the nearest public library could furnish. He then goes on to describe conditions of Brazilian climate, productions, social customs, and the like, which make it impossible for many articles of American manufacture ever to find a market there, pointing out at the same time several lines of manufactures which, by proper management, might be sold largely in that part of the world.

A particularly suggestive and valuable part of the report will be found in the comparison made between the methods of German commercial agents and merchants and those of our own country. The mercantile training of the former embraces not only all the details of office work, but a thorough knowledge of geography and of the products of every land, of mercantile law, and of at least two languages besides their own. The first business of the German agent is to master the language of the people he is to trade with, if he has not already acquired it. Similar qualifications are the exception among the ambassadors of American trade. The majority of them have to employ an interpreter to make their business known, and the interpreter can rarely speak so as to compel attention and belief. Under such unfavorable conditions it is not surprising that American agents in Brazil are apt to be less successful than those of German houses. On the other hand, manufacturers of goods suited to the Brazilian market, who have intrusted their business to competent agents, have been very successful.

Speaking generally, Mr. Adamson says that if the present business of an American manufacturer will warrant his spending a thousand dollars to study the Brazilian market, he should personally visit Rio Janeiro to see for himself whether his wares are adapted to the wants of the people, or whether they can be altered to suit that market. If these questions find an affirmative answer he should establish a live man from home as his agent in Rio Janeiro, with capital to tide over the first few months. In the case of American stoves it took years to get them introduced and teach the people how to use them; but with industry and perseverance the field was won, and a large demand for the article is certain. In like manner our sewing machines have made for themselves a splendid market in Brazil.

In this connection Mr. Adamson's statistical report of the trade of Brazil with different countries, the lines of steamships plying between Brazilian and foreign ports, and so on, will be found especially valuable.

NEW METHOD OF PRODUCING PHOTOGRAPHIC PICTURES IN COLORS.

At a recent meeting, in Paris, of the Photographic Society of France, M. Bounaud exhibited specimens of his new system of colorization, which attracted much attention. The process is as follows: A negative is taken in the usual manner, from which as many prints on paper are made as there are to be colors in the finished picture. If, for instance, it is a portrait of a lady, to be furnished in four colors—blue, orange, red, and green—four paper prints are made. From one of the prints all the parts that are to have the same tint are carefully cut out; for example, the lady's dress and the sky, which are to be blue, are cut out; from the next print the trees and grass are cut out, as these are to be tinted green, and so on. The cut prints being arranged to "register" are now to be used as stencils, and are successively laid upon a sheet of paper and colors thereto applied, through the stencils, by means of a brush—an operation which requires little skill and may be done by girls. The paper with the stenciled figure upon it, in the different colors, is now albumenized and then sensitized in the usual manner in the photo bath; after which the original negative is applied and a photo print made upon the sensitized colored sheet, then developed and toned as usual. Photographs thus made are said to be attractive, the gradations of light and shade in the colors being excellent, and the effects very pleasing.

The process is simple, costs but little, and the pictures, it is said, may be rapidly produced. Where large numbers of the same colored picture are ordered stencil plates are made in sheet brass, the parts taken from the paper print being used as patterns to cut the brass.

THE TAY BRIDGE DISASTER.

The most appalling of railway disasters occurred on the evening of Dec. 28, at the bridge over the Frith of Tay, on the railroad between Edinburgh and Dundee, Scotland. At this point an iron bridge two miles long crosses the Frith on 85 spans, ranging from 18 to 88 feet above the water. Of these spans, six were 27 feet, fourteen of 67 feet 6 inches, fourteen of 70 feet 6 inches, two of 88 feet, one of 162 feet, one of 170 feet, and thirteen of 245 feet. The long spans near the center of the bridge were the highest above the water.

On the evening of the disaster a train from Edinburgh to Dundee, comprising locomotive and tender, four cars of the third class, one of the second, and one of the first class, and a brakeman's van, entered upon the bridge near seven o'clock, a high wind blowing at the time.

In the bright moonlight the train was seen to reach the middle of the bridge over the navigable part of the Frith, then, suddenly, with a flash of fire it disappeared. Subsequent examination found that a section of the bridge half a mile in length, comprising a dozen or more of the longer and highest spans, had fallen, and the train had been precipitated into the gulf. The railway officials report that the falling girders made a very clean break from that portion which remains standing. Almost the only signs of the catastrophe are in the ends of the rails where they were torn asunder. The rails remaining appear wrenched out of their chairs for a few yards.

For some hours the furious gale prevented boats from reaching the scene of the disaster. By that time no vestige of the wrecked train could be found; and for a long time divers were unable to discover any traces of it in the quicksands of the bed of the Frith.

The first report of the managers of the railway said that there were nearly three hundred passengers on the train besides the train-men. Not one survived. Later the authorities estimated the loss as low as seventy-five. The exact number will probably never be known.

It is impossible at this writing to obtain any clew to the cause of the disaster. The gale is said to have been the severest experienced in Scotland since 1868. It is most probable that the bridge was blown down. That its fall was occasioned by a derailment of the train by the wind, does not seem likely in view of great length of bridge destroyed. That the foundations of the piers were not undermined seems probable from the circumstance that one report speaks of the piers as still visible. Whatever the cause, the disaster remains the most remarkable and terrible in the annals of railroading.

A detailed account of the construction of the fatal bridge, with illustrations, was printed in the SCIENTIFIC AMERICAN SUPPLEMENT of April 7, 1877, and an account of the completed structure and its inauguration in the SUPPLEMENT for July 20, 1878.

OUR VENOMOUS SNAKES.

The danger from venomous snakes in the United States, though small as compared with that in warmer countries, is none the less real; and the destruction of such snakes should always be encouraged. But unfortunately the popular notion of snakes, instead of making venomous species the exceptions, makes them the rule. This erroneous notion, coupled with a natural and perfectly proper feeling that no opportunity of destroying a dangerous reptile should be neglected, deals havoc alike to the harmful, the neutral, and the useful of serpent kind.

Of course such a wholesale war entails the destruction of many serpents that are not only harmless but useful. And in this connection it may be worthy of notice that nonvenomous snakes, which commonly attain a length of but twenty inches or less, subsist chiefly upon insects, worms, etc., and should be regarded as friendly to the interests of agriculture.

A generally available means of determining at sight whether a snake is venomous or harmless is therefore desirable.

As a general rule, the venomous snakes have thick bodies and broad, triangular heads, which they flatten when they wish to assume a threatening aspect; while the innocuous snakes have slender bodies and narrow heads, which they do not flatten. This rule is often laid down as a sufficient guide in this matter; but it is far from reliable. We have venomous species of colubrine form and of mild disposition, as well as innocuous species with the viperine form and habits.

Nor is there known any infallible external criterion of the nature of a snake. Even the herpetologist, upon discovering a new and apparently harmless species, cannot with certainty pronounce it to be harmless from its external appearance alone.

In order, therefore, to improve every opportunity of destroying those which are venomous, and at the same time to encourage those which are innocent, an acquaintance with some of the more obvious specific characters of certain serpents is indispensable. But if we inquire into the matter, we shall see that the number requiring such an acquaintance is very small.

In North America, including Lower California and Sonora, in Mexico, there are one hundred and thirty-two species of snakes. Of these twenty-two, or exactly one sixth, are venomous. (The ratio of one to five, however, should by no means be taken as the numerical ratio of the venomous snakes to the harmless, since the former are far less numerous individually than specifically.)

It is plain that an acquaintance with the twenty-two venomous species renders a knowledge of the one hundred and ten harmless species unnecessary. But sixteen of the twenty-two are rattlesnakes—belonging to three different genera, it is true, but for our present purpose merely rattlesnakes, since all possess rattles. The nature of the rattle is so well known in districts where these snakes occur that no description of it is here called for; and as this organ is so conspicuous, rendering the rattlesnakes easily distinguishable, these may be stricken from the number of venomous serpents whose recognition requires their specific acquaintance.

Of the six remaining species, two offer well marked varieties, a knowledge of whose appearance is important. We thus have but eight "kinds" of serpents requiring for their immediate recognition as venomous a knowledge of their form and markings.

But except for those whose pursuits lead them over widely separated localities, it will be unnecessary to know the appearance of even this small number. From one to three of them only will be found in most parts of the United States. In the region west of the Sierra Nevada not one of them occurs, the venomous serpents being represented by rattlesnakes alone. In the Northern States there is but one, the copperhead. In the mountainous districts of North Carolina and Tennessee four of them may be met with.

Now, as to the method of obtaining a practical distinguishing knowledge of these few snakes. Let advantage be taken of the first opportunity of killing a snake suspected to be one of them. If, by the presence of the "pit" or of fangs, it is determined to be venomous, note carefully such peculiarities of markings and form as may be most readily observed in other specimens of the same when seen alive in their native haunts. The specimen should then be preserved in spirits, so as to be available at any time for comparison with harmless species to which it bears a superficial resemblance.

Our venomous snakes, exclusive of the rattlesnakes, are comprised in two genera, *Ancistrodon* and *Elaps*. In either genus there is but one pair of fangs—long, slender, recurved teeth, situated in the forward portion of the upper jaw. In the genus *Ancistrodon* the fang is concealed in a fold of the gum, so that it is unsafe to presume upon its absence from a mere inspection. It must be pried out into sight by some sharp-pointed instrument. In this examination the greatest care should be exercised, as the venom continues to be secreted for some time after the death of the reptile, and a wound from the fang would probably at any time cause severe inflammation, if nothing more serious.

The fangs in the genus *Elaps* are permanently erect, smaller, and situated further back than in *Ancistrodon*.

The "pit," above mentioned, is a small cavity about midway between the eye and the nostril, and a little below the line joining them. While not common to all venomous snakes, it is seen only in those which are venomous; so that its observance will often obviate the necessity of looking for fangs.

To those who lack time for gaining such a practical knowledge of our serpents, the following fact in regard to them may be of interest. All snakes of uniform color upon the upper surface of the body, or marked with longitudinal bands or stripes, are innocuous. F. W. CRAGIN.

Long Distance Telephoning.

An interesting trial was made with Bell telephones, Dec. 26, between Dayton, Ohio, and Indianapolis, Indiana, a distance of 108 miles. The wires of the American Union Telegraph Company were used, and the experiment proved conclusively the utility of Bell telephones for distances within 100 miles. Conversation between the exchange offices of the two cities was maintained throughout the day. A circle of 100 miles radius, with New York as a center, includes all the western part of Connecticut as far as New Haven, with its numerous large and growing towns and cities; the Hudson River cities as far as Hudson, taking in Poughkeepsie, Newburg, Sing Sing, and other large places; all the cities and towns of New Jersey; Wilmington in Delaware; and Philadelphia, Reading, Easton, Scranton, and other large places in Pennsylvania. A slight addition to the radius, still without much exceeding the distance between Dayton and Indianapolis, includes Hartford on the northeast and Baltimore on the southwest. All these great centers of population and trade are thus already within possible telephonic reach of New York; and it is quite within the limits of possibility that the end of the current year may see business men in this city dealing directly, by word of mouth, with customers scattered over all this wide reach of country.

South American Exhibition.

The United States Consul at Buenos Ayres, in a dispatch to the Department of State, dated October 21, 1879, announces that a Continental Exhibition will be opened in that city on September 15, 1880, to continue until December 15 of the same year. The Exhibition is to be divided into six sections. All the nations of South America can contribute to and compete in the Exhibition; but the United States and Europe are limited to one section for machinery only. This section is divided into eleven groups, consisting of hydraulics, mining, metals, casting of types, bookbinding, agricultural implements, and several other groups. The usual directions to exhibitors have been published in pamphlet form.

Goods for the Melbourne Exhibition.

Mr. Thomas R. Pickering has been named by the Secretary of State, at Washington, as agent for the United States Government to solicit exhibits for the Melbourne Exhibition, to begin October 1, 1880. Mr. Pickering's office is in room 102, Post Office Building, New York city, where information in regard to the Exhibition can be had. The United States will not assume the expense of shipping goods, but will, through their commissioner, receive goods at Melbourne, find them place in the Exhibition buildings, and publish a list of the exhibitors.

Cactus Fiber.

A species of dwarf cactus abundant in Lower California is rich in fiber, said to be excellent for mattresses. It is reported that an experimental machine, costing only $400, converts the raw material into white, elastic fiber with great rapidity, and promises to reduce the cost and improve the quality of such goods very materially.

How Connecticut Manufactures are Booming.

We learn that the Wheeler & Wilson Sewing Machine Company, of Bridgeport, Conn., has at present on hand orders for ten thousand sewing machines in advance of the capabilities of their immense establishment.

EDISON'S VACUUM APPARATUS.

With the exception of the peculiar carbon used by Mr. Edison in the construction of his lamps, there is nothing of more vital importance in the development of his system of electric illumination than the apparatus employed to exhaust the air from the little globes containing the carbon horseshoes, for upon the perfection of the vacuum depends the success of the lamp.

Since Otto Von Guericke invented the air pump in 1650 it has been the subject of various modifications and improvements; but the most perfect forms of piston air pump yet devised are incompetent to produce the degree of exhaustion demanded by modern experimenters.

In vacuum apparatus, as in most things connected with scientific investigation and experiment, the simplest means and methods prove the best. It seems that in the natural course of invention, simplicity is the latest feature attained. Air-pumps and vacuum apparatus form no exception to this general truth. The most recent as well as the most perfect air pumps consist essentially of a glass tube and a column of mercury. Two forms of mercurial pump are used by Mr. Edison in removing the air from his lamp bulb; one for exhausting the greater volume of air, the other for perfecting the vacuum. The first is the invention of Geissler; the second, of Sprengel. The engraving shows the arrangement of these pumps in connection with the McLeod gauge, and other accessories.

Several sets of this apparatus are employed by Mr Edison, and he has so far improved their construction and working as to enable the attendant to produce very high vacua in twenty five minutes.

The Geissler pump, A, the Sprengel pump, B, and the McLeod gauge, C, are all connected with the socket that receives the lamp bulbs, through the bulb, E, which is partly filled with phosphorous anhydride—a powerful absorbent of moisture—and through the bulb, F, which contains gold leaf to absorb traces of mercurial vapor. Each set of apparatus is secured to a vertical board, behind which on a bracket near the top sets a reservoir of mercury, which supplies the Sprengel pump, B, through the flexible tube, *a*, and through a vertical glass tube, having at the top a trap, *b*, for receiving any air that may be carried by the mercury.

The Sprengel pump, E, consists of a glass tube about ⅛ inch in internal diameter and 36 inches in length, dipping at its lower end into mercury contained in the small vessel resting on the bracket, and having an overflow connected by a flexible tube with a mercury receiver. At the upper end of the ⅛-inch tube is formed a bulb, into which the mercury supply tube enters through a sealed joint (described elsewhere) and extends about two-thirds of the way down the bulb. The bulb is provided with a lateral tube by which it is connected with the Geissler tube, D, and with the bulbs, E and F, which communicate with the lamp bulbs, G. The Sprengel pump also connects with the Geissler pump, A, when the stopcock, *c*, is open.

The Geissler pump, A, is simply a glass tube, having a bulb blown in it, and communicating at its lower end with a mercury reservoir through a flexible tube, and connecting at its upper end with the Sprengel pump, B, as before described, and also with a bent discharge tube, *d*, of small caliber, which extends downward something over 36 inches and dips into mercury contained in a small cup provided with an overflow.

The McLeod gauge is no more complicated than either of the pumps. It consists of a bulb, *c*, blown on the end of a tube of small diameter, and having a still smaller tube, *f*, projecting from its upper surface. This tube is closed at the top, and its capacity bears a certain ratio to that of the bulb. It extends over the face of a scale, *f*. The longer and larger tube of the gauge is connected by a flexible tube with the mercury bottle seen resting on the bracket; and it is also connected by a small tube, *g*, with the system of

A.—Geissler's Pump. B.—Sprengel's Pump. C.—McLeod's Gauge. D. Geissler Tube. E. Bulb containing Phosphorous Anhydride. F.—Bulb containing Gold Leaf. G.—Electric Lamp Bulbs. *a*. Mercury supply Tube. *b*.—Air Trap. *c*. and *c*.—Mercury Sealed Stop Cocks. *d*.—Discharge Tube. *f*.—Scale. *f*.—Gauge Tube. *g*. Connecting Tube. *h*.—Mercury Sealed Joints.

VACUUM APPARATUS FOR EXHAUSTING EDISON'S ELECTRIC LAMPS.

tubes that connects the two pumps, the Geissler tube, and the lamp bulbs. The connecting tube, *g*, extends over the scale, *f*, parallel to and near the gauge tube, *f'*.

To produce a vacuum in the bulbs, G, the pinch-cock on the rubber pipe, *a*, is opened so as to permit a rapid succession of drops, or a full stream of mercury to flow down the internal tube of the Sprengel pump, B. This stream of mercury, falling through the space between the internal tube and the lower end of the bulb, enters the long tube of the pump, and carries with it a certain quantity of air, which is discharged together with the mercury into the cup at the bottom. As this process is too slow for creating a vacuum from the beginning, while the Sprengel pump is still working, the Geissler pump, A, is brought into use for removing the greater portion of the air. To operate this pump, the stopcock, *c*, is first closed, the reservoir of mercury—connected with the pump by a rubber tube—is raised by the attendant, as represented in the cut, until mercury flows up the long pump tube, and filling the bulb, drives out the air before it through the discharge tube, and finally overflows through the tube, *d*, into the cup at the lower end of the tube. The mercury reservoir is then lowered until the two vertical columns of mercury break in the bend of the discharge tube, and the mercury in the pump is below the stopcock, *c*, the latter is then opened, and the mercury reservoir is lowered until the mercury in the pump will sink no farther. The stopcock, *c*, is then closed and the operation is repeated two or three times. The Sprengel pump, which has been in operation meanwhile, is now permitted to finish the work. As the vacuum becomes more and more perfect the mercury rises in the pump, and when the drops strike the mercury column, a sharp metallic clink is heard, indicating that the atmospheric resistance to the falling metal is little or nothing. As fast as the mercury accumulates in sufficient quantities in the reservoir below, it is poured into the reservoir above.

Electric sparks from an induction coil are continually

Fig. 2.

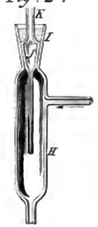


Fig. 3.

passed through the Geissler tube, D, as long as the vacuum is low enough to admit of it. Mr. Edison says that when a 9 inch spark fails to pass the ½ inch space between the electrodes in the tube the vacuum is still coarse.

The McLeod gauge is relied on mainly for testing the perfection of the vacuum. This gauge is operated by simply raising the mercury reservoir connected with it until the gauge bulb is sealed off from the other parts of the apparatus, the mercury, as it rises, closing the connecting tube, *g*. The mercury reservoir is then raised still further, until the mercury will go no higher in the gauge tube, *f'*. Should the mercury rise to the end of the gauge tube it would indicate a perfect vacuum, but this is never attained. The quantity of air contained in the tube, *f'*, indicates exactly the proportion of the air in the apparatus to the capacity of the apparatus or air at its normal density. Another method of calculating the value of the vacuum is based upon the difference in the level of mercury in the two tubes in front of the scale, *f*.

Mr. Edison informs us that the vacuum in his lamps is so nearly perfect that only a millionth of the original volume of air remains.

It is obvious that the Sprengel and Geissler pumps must be longer than a barometer, to obtain the full effect of the falling column of mercury. All of the rigid parts of this apparatus are made of glass, and wherever there is a joint or a stop cock, it is sealed with mercury. Figure 2 shows the upper portion of the Sprengel pump in detail, and also gives a good idea of the manner of sealing the joints. The bulb, H, has a conical mouth, I, into which is fitted and ground the enlarged portion, J, of the mercury tube, K. The space in the mouth, I, above the enlarged part of the tube, K, is filled with mercury.

Figure 3 represents a mercury-sealed stop cock, L being the stop cock, entirely surrounded by mercury contained in the cup, M.

The lamp bulbs, G, are connected with the apparatus by a joint similar to that represented in figure 2. From time to time, while the air is being exhausted from the lamps, they are tested by connection with wires from the electrical generator. When the vacuum is practically complete, the tubes connecting the lamps with the vacuum apparatus are heated by a spirit lamp, sealed and separated from each other and from the apparatus.

LABORATORY APPARATUS.

The laboratory apparatus designed and patented by Thomas Fletcher, F.C.S., of Warrington, England, has been long and favorably known in Europe, and has recently been largely introduced in this country by the Buffalo Dental Manufacturing Company, of 307 and 309 Main street, Buffalo, N. Y., who have made arrangements with Mr. Fletcher to manufacture all of his specialties.

The apparatus, consisting of hot and cold blast blowpipes, blowing apparatus, gas furnaces with and without blast, ingot moulds, and a great variety of other articles, is designed for colleges, academies, schools, chemists, assayists, manufacturing jewelers, dentists, artisans, and experimenters.

We have chosen a few of the leading articles for illustration and description.

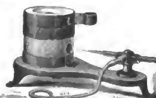


Fig. 1.—FLETCHER'S NEW CRUCIBLE FURNACE.

Fig. 1 shows a new crucible furnace, consisting of a simple pot—for holding the crucible—with a lid, and a blowpipe, all mounted on a suitable cast iron base. As compared with the ordinary gas furnace it appears almost a toy, owing to its great simplicity.

The casing, which consists of a new material discovered by Mr. Fletcher, holds the heat so perfectly that the most refractory substances can be fused with ease, using a common foot blower. Half a pound of cast iron requires from seven to twelve minutes for perfect fusion, the time depending on the gas supply and pressure of air from the blower.

The power which can be obtained is far beyond what is required for most purposes, and is limited only by the fusibility of the crucible and casing. A suitable crucible will hold about ten ounces of gold.

An ordinary gas supply pipe, five sixteenths or three eighths will work it efficiently. It is said to require a smaller supply of gas than any other furnace known. About ten cubic feet per hour is sufficient for most purposes.

Any common blowpipe bellows will work the furnace satisfactorily except for very high temperatures (fusion of steel, etc.), for which a heavy pressure of air is necessary.

The furnace shown in Fig. 2 will take crucibles up to four by three and a half inches, and with half inch gas pipe, giving a supply of about thirty feet per hour, will melt three or four pounds of brass in about twenty five minutes, and the same quantity of cast iron in about fifty minutes from the time the gas is first lighted, without the slightest trouble or attention. It will melt a crucible full of silver or gold in twenty-five minutes. The crucible will hold and melt about six pounds when quite full. It is made in a very substantial manner, and is recommended

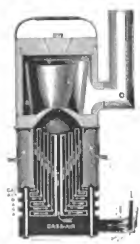


Fig. 2.—LARGE CRUCIBLE FURNACE.

as a first-rate furnace for manufacturing jewelers, reducing photo. waste, etc. In using this pattern of furnace, the narrow end of the plumbago cylinder which surrounds the crucible is always put downward. The use of this cylinder is to keep the flame in contact with the crucible up to the top. The flame is then deflected by striking against the lid, and, turning downward, leaves the furnace by the chimney, at the lower side.

The lid never gets very hot, and can be lifted away by the handle across the top; it is now made of the patent non-conducting material, in one piece, with an opening in the center for convenience in examining work. This pattern of furnace requires no blast.

The furnace shown in Fig. 3 takes crucibles up to two and a half by two and a quarter inches outside. This pattern is more especially designed for gold, silver, copper, etc., and, as sent out, with four foot chimney and single lid, E, is amply powerful. If required for temperature up to the fusing point of cast iron, it requires a chimney six feet high.

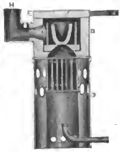


FIG. 3.—Small Crucible Furnace.

FIG. 4.—Ladle Furnace.

The ladle furnace represented in Fig. 4 takes ladles up to six and a half inches diameter, and will melt six or eight pounds of zinc in about fifteen minutes, or the same quantity lead, tin, etc., in half the time. It is a convenient and powerful arrangement for dentists, heating soldering irons, etc.

Fig. 5 shows a simple, compact, and powerful blower. The step for the foot is very low, and enables the blower to be used with ease whether the operator is standing or seated. The pressure is steady and equal. If the rubber disk is distended until forced against the net, the pressure can be increased to almost any extent desired. It will give, if required, a heavy and continuous blast through a pipe of one quarter inch clear bore.

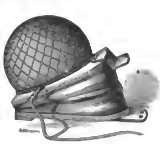


Fig. 5.—FOOT BLOWER.

These compact and well designed pieces of apparatus supply a want long felt by our artisans and experimenters, and will undoubtedly meet with the success they merit.

The Buffalo Dental Manufacturing Company supply an illustrated catalogue giving descriptions of many other pieces of apparatus of this character.

Preserve Your Papers.

Thousands of subscribers understand this, save their numbers, and have them bound at the end of the year; others thoughtlessly lose or destroy the first few numbers they receive after subscribing, and subsequently regret they had not preserved them. A year's numbers make a volume of over 800 pages, and to every one it will be found useful for reference.

Bound volumes of the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT, for 1879, are now ready, and for sale at the office of publication. Orders are also filled by all News Agents.

A Safe Investment. Dividend Every Week.

The commencement of a year and the beginning of a volume are the best periods for subscribing for either magazines or newspapers. The SCIENTIFIC AMERICAN at this time embraces both these conditions. A new volume commenced with the new year, and any person not a subscriber into whose hands a copy of this paper may fall is invited to become a subscriber at once, and receive its weekly visits during the year 1880. Nothing will return a better income than $3.20 thus invested. Dividends every week without any liability for assessments, payable at the home or office of the subscriber, free even of postage. Try the SCIENTIFIC AMERICAN for 1880.

Starch Photo. Process.

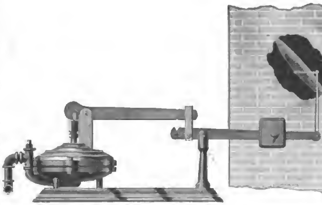
In consequence of the remarkable results obtained by gelatine and silver bromide, experimentalists have been induced to try starch and gum emulsions, and the latest contribution to this branch of photography is a formula for a starch emulsion by Senors Pauli and Ferran, of Barcelona. Take four grammes of potato starch and mix to a creamy consistency with twenty grammes of water; then add slowly eighty c.c. of boiling water, and, while the fluid is still hot, 1·12 grammes of bromide of potassium and 1·62 grammes of silver nitrate dissolved in twenty c.c. of water. It is recommended to add a little gelatine to the starch, in order to lessen the solubility.

NEW DAMPER REGULATOR.

We give herewith an engraving of a recently patented automatic damper regulator, embracing several novel and valuable features. The mechanism of this regulator insures a large increase of leverage, movement, and sensitiveness, by the use of a compound lever, having adjustable fulcra, by means of which the same machine is adapted to the use of either high or low pressure; each regulator is provided with a siphon attachment, to prevent the contact of steam with the diaphragm. The diaphragm is perfectly supported, and is arranged so as to roll instead of stretching or wearing it, thus making it more durable than other forms of diaphragm.

This regulator will be readily understood by reference to the engraving, and will be appreciated by practical engineers. The great saving in fuel, the steady power, the regularity of speed, and the guaranty of safety from explosion by excessive steam pressure, are features which must recommend it to all steam users. It is claimed by the manufacturers that it will control the pressure of steam within one pound, and *fully* open or close the damper on a variation of two pounds.

The American Steam Appliance Company, of 13 and 15 Park Row, New York, and 28 School street, Boston, Mass., are sole manufacturers of the regulator.



PEERLESS DAMPER REGULATOR.

The Lick Observatory.

The recent decision of the courts with regard to the Lick estate in California gives the trustees of the estate $700,000 for carrying out the observatory project, which will be pushed forward as rapidly as possible. The question as to the kind of telescope to be adopted has not yet been settled, and the respective merits of the reflecting and the refracting telescopes are being investigated. As the trust deed directed that the instrument should be the most powerful in the world, a refractor of over thirty inches in diameter will have to be obtained, as two of twenty and thirty inches have recently been ordered, respectively for the Vienna and Pultkowa observatories. It will take two years from the time the order is given before the disks will be ready for the opticians, and it is calculated by the trustees that three years will elapse before they can turn their attention to the third bequest, the School of Mechanic Arts.

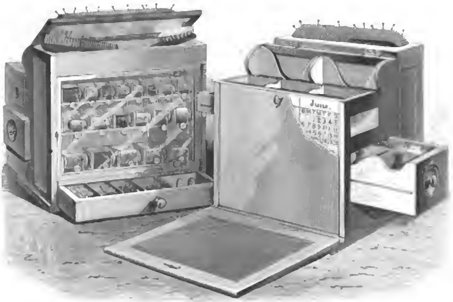
NOVEL TOILET CABINET.

The accompanying engraving shows opposite sides of a compact and convenient cabinet recently patented by Mr. F. C. Zanetti, of Bryan, Texas. It is designed for containing sewing, writing, and shaving materials, and various other articles of domestic use in frequent demand. In this receptacle these articles can be arranged in an orderly and convenient manner, so that any one or more of them can be obtained, when needed, instantaneously and without trouble.

The invention consists of an outer case, divided inside by horizontal and vertical partitions into three separate compartments. The first of these compartments, at the front of the cabinet, is provided with a mirror at the back, racks for spools, razor cases, and razor strop, and is closed by a glass door, on the inside of which are fixed racks for spools, and through the glass, opposite each spool, are perforations through which the ends of the threads are passed, so that the thread can be taken from the spools without opening the door. A subdivision of this compartment above serves as a receptacle for brushes and combs, and the cover of the receptacle has a mirror on its under side and a pincushion on the upper side. The second compartment is subdivided for the reception of drawers adapted to be drawn halfway out from each end, and envelope, card, and paper cases and pen racks. The third compartment is provided with a drawer opening from the front of the cabinet, said drawer being subdivided into cells for the reception of various articles used in sewing and mending. The back of the cabinet is provided with a hinged and folding slate and writing tablet and a place for a large calendar.

This cabinet is designed to contain a class of articles that too often are not provided with a place, and are liable to be found almost anywhere in the house.

Further information may be obtained from the inventor.



ZANETTI'S TOILET CABINET.

The Unitary Theory of Electricity.

Herr Edlund has drawn attention to an electrical experiment that has not hitherto been thoroughly explained. Let an open metal tube or cylinder, capable of rotation about its axis, be placed over a magnet of double its own length, so that its lower end is opposite the middle of the magnet, while its upper end is opposite the magnet pole. Then let a current of electricity of sufficient strength be passed from one end of the tube to the other. The tube is found to rotate with a velocity which is independent of the resistance of the metal of which it is composed and of its thickness. Longitudinal slits cut in the tube do not affect its rotation. There is, therefore, here a complete conversion of electromotive force into ponderomotive force. W. Weber inferred that the resistance of the movable conductor to the passage of the current is the medium of this transfer of the energy, and argued that the first tendency is to rotate the current in the conductor, but that as this could not be done without moving electricity through the substance of the conductor, and therefore against its resistance, the principle of least heat requires that the energy should be transferred in an indefinitely short time to the conductor itself, which therefore rotates. Herr Edlund, however, sees in the experiment a confirmation of his "unitary" theory of electricity.

Preparation of Cotton for Pyroxyline.

M. Aimé Girard is the author of a new means of preparing cotton to fit it for making pyroxyline. The cotton is thoroughly impregnated with a solution of carbonate of soda, and, when well washed, it is then thoroughly dried. The cotton thus treated is then plunged into a bath composed of water, 100 parts, nitric acid, 3 parts.

A very pulverulent cotton is thus obtained, which M Girard names "hydro-cellulose." It appears that this product is far superior to the ordinary cotton for obtaining excellent pyroxyline for photographic purposes. The photographic pyroxyline is obtained by immersing the hydrocellulose in a solution composed of sulphuric acid (66°), 1800 grammes, nitric acid (40°), 680 grammes.

After twelve minutes' immersion the pyroxyline is thrown into a basin of water and then well washed under a tap. It is then allowed to dry spontaneously in a dry room.

STEREOSCOPIC LANTERN PICTURES.

As you have again opened this interesting subject, I shall be glad if you will permit me to place on record a few thoughts of my own respecting it.

The production of stereoscopic effect by the lantern upon a large screen has at intervals, for a considerable period of time, been the object of experiment with me, says Mr. John Harmer, in the *British Journal of Photography*, the outcome of which, up to the present, is a method of obtaining it having one of the disadvantages of, though it appertains to, the other methods mentioned in your leading article, namely, the necessity for each spectator to be provided with a piece of apparatus to make the effect evident.

The arrangement requires a couple of lanterns—one to project the left eye half of a stereoscopic transparency, the other the right eye one, each of which when projected must occupy as nearly as possible the same part of the screen, and being, if viewed together, in hopeless confusion. In front of the two lanterns must be fixed a revolving disk, pierced with three apertures in such a position with respect to the lanterns that the light shall not be allowed to pass from one of these instruments till the other is exactly shielded. With this disk in motion the right and left halves will be thrown alternately upon the screen, producing, if the motion be sufficiently rapid, just the effect of two open lanterns, the only difference being that the extremely small intervals of darkness would slightly reduce the illumination without affecting the continuity of the mental impression in the least.

The piece of apparatus necessary for resolving this confusion into stereoscopic effect is composed of two eyepieces, having a revolving disk similar to the one just described in every respect except size, this latter bearing the same proportion to the larger disk as the eye does to the lantern lens. The revolutions of these must synchronize exactly, so that when the left eye picture is allowed to pass to the screen the left eye must be uncovered to view it, the same being required for the right eye and its picture, and the rate of motion must be such that the alternate projection of the pictures must take place not less than ten times per second. Each eye will then see its own proper picture in the same direction, and will deal with the dissimilar impressions as with those obtained direct from nature.

The synchronous movement of the disks could be obtained, if the apparatus were fixed by band and pulley, or, to secure the advantage of portability, by a small electro-magnetic engine and phonic wheel, by which a number of disks could be driven. If the above were constructed for exhibition purposes the disks could be arranged to produce stereoscopic, pseudoscopic, and superscopic effects—the first by an eyepiece adjusted as above, the second by providing for either to be uncovered at the instant the picture for its fellow was visible, and the last by a disk revolving at half the rate of the lantern one, thus cutting off the light of one lantern entirely.

In your *résumé* you omitted to mention a very excellent method discovered by the late M. Claudet some years ago, which he described and exhibited before the Royal Society at the time. He obtained the key note in the following manner: While experimenting with a "focimeter" he noticed that the image of the instrument upon the focusing screen of the camera appeared to possess its three dimensions—length, breadth, and thickness. This at once led him to investigate the cause, which he found to proceed from the fact that each eye actually sees a different view of the image produced by a lens upon a translucent screen, the natural object appearing to be viewed by the eye through screen and lens, the relations of its parts being affected by any change, just as would be the case if no apparatus were interposed, size excepted. This principle he embodied in an arrangement for exhibiting stereoscopic effect on a large scale in this wise: A large sheet of ground glass was erected perpendicularly, behind which, at a suitable distance, were placed a couple of lanterns, each one inclined inward sufficiently to throw its half of the stereoscopic picture upon the screen, with the axes of the lenses crossing there, to press onward into the eyes of the spectator some feet in front. It is manifest that this cross-

ing will necessitate the right-eye picture being put into the lantern on the left hand, the left eye one into that on the right, and the ground glass to be viewed from a fixed position in front, thus preventing the effect from being observed by many persons together.

AMERICAN INDUSTRIES.—No. 28.

THE MANUFACTURE OF WOOD-WORKING MACHINERY.

Among the various mechanical industries of the world there is none—with perhaps the exception of iron—which is more widely spread or employs more capital and labor than the working of wood in the manifold uses to which it is applied. In the present advanced state of manufactures machinery is employed for nearly every process to which wood is subjected. From the wooden toothpick to the railway car or the palace of royalty, machinery is used for producing the required form. The manufacture of machinery for working wood has become, therefore, one of our most important industries, for only by securing the greatest perfection in the machinery employed, can the best results be obtained.

We have selected as the representative of this industry the house of C. B. Rogers & Co., at Norwich, Conn., the oldest as well as one of the largest engaged in this business. The house originated at Keene, N. H., in 1832, when Mr. J. A. Fay commenced the manufacture of mortising and tenoning machines for sash and door work. Previous to that time, with the exception of the Woodworth and Daniels planers, saws, and a few special tools, very little wood-working machinery was used. The new machines made by Mr. Fay met a ready sale and increased demand, and in 1848 Mr. C. B. Rogers engaged with Mr. Fay in the business, opening a factory at Norwich, Conn., for the purpose, and bringing out the sash sticking machine, which met with such an unprecedented demand that for over three years one machine per day was the average sale. A few years later a shop was started at Worcester, Mass., which was devoted to Woodworth and Daniels planers.

In 1861 the death of Mr. Fay, together with the need of condensation of the business at some central shipping point, made it advisable to remove the entire business to Norwich. The firm was made into a joint stock corporation, a large works erected to accommodate the whole business, and the name, which up to this time had been J. A. Fay & Co., was changed, and the present title, C. B. Rogers & Co., adopted. The history of the establishment from the start has been one of progress, and the inventive talent of the managers has been kept constantly employed to keep pace with the demand for improvement. Many of the most indispensable machines in use originated with this house—notably the power mortiser, tenoning machine, sash sticker, and four side moulding machine.

The works, of which the central cut of our first page illustration is a fine representation, are located in the city of Norwich, Conn., on the banks of the river Thames. The location is most excellent as regards freighting facilities—an important item with this class of goods—the city being midway between Boston and New York, with a daily line of steamers to the latter, and two railroads centering there, by which freights may be forwarded expeditiously to all points, and are by special arrangement to all Western points at the regular New York freight tariff. The works, including the foundry, cover nearly three acres of ground. The manufactory surrounds three sides of a quadrangle, and consists of the main building, 125x45 feet, four stories, with blacksmith shop, 30x25 feet, attached; a wing, 65x40 feet, four stories; and a second wing, 50x20 feet, three stories. The fourth side is occupied by a storehouse, 100x30 feet, three stories, for lumber and coal. The factory has about 40,000 feet of floor space.

Entering the works at the north end, ground floor, we come first to the motive power, steam, applied to an 80 horse power high pressure double engine, built by this company, running 125 revolutions, and so delicately adjusted in its valve motion that the stoppage of half the tools in the building can scarcely be detected in the speed. Passing the engine, we enter the "planer room," so-called from its being devoted exclusively to the manufacture of planing and matching machines. Our artist has sketched this room entire, with the various planers in process of construction. Of this class of tools this house make twenty different sizes and styles, from the diminutive "Pony," so-called, to the planer and matcher weighing from four and one half to five tons. The greatest care is used in the construction of these machines, and the latest improvements and processes are applied. A recent one is the use of cast steel for all cylinder heads, as well as for the smaller gearing where the wear is greatest. The severe tests to which these machines are put have always proved successful and eminently satisfactory to the user. In the center of the room, but upon the outside, is an elevator running to the fourth story, and sufficiently powerful to raise the heavy planers to the street level for shipment.

Leaving the planer room, we pass through a store room filled with bar iron, of all shapes and sizes, and enter the blacksmith shop, which has six forges, two trip hammers, power shears, and all facilities for the various forgings. From here we ascend to the second floor, machinist room. This floor is engaged on moulding machines, of which seven sizes are made; sash machines; mortisers, twelve sizes; tenoners, seven sizes; band saws, three sizes; scroll saws, railway cutting off and splitting saw frames, resawing machines, and various other tools.

Passing the casting room, where tons of castings are in process of cleaning, we ascend the main staircase to the third floor or "wood room." This floor is engaged upon woodwork; framing machines, making foundry flasks, pattern work, of which a large amount is required in the production of new machines and alteration of the old. Although iron frames are the rule for most machinery, some of the wood frames are still retained as being lighter and cheaper—as the sash machine, tenoner, saw tables, etc. The frames retain their position equally with iron, but to insure this a large stock of hard wood is kept in store and seasoned for years before using. On this floor is the paint room, where the finishing touches are applied and the gray iron rendered more agreeable to the eye. At the south end of the room—the foreground in the sketch—is one of the most important departments in the building, where every machine before being shipped is thoroughly tested on the work it is designed to perform, and any error or oversight in the construction corrected. This was for many years a system followed only by this house, and its value has been amply proven by the universal success of the machines sent out.

Many purchasers have but a limited knowledge of machinery, and it is a great assistance to them to receive their machines all set and with tools prepared ready to set at work. The machine shown as being tested is a vertical tenoning machine made for tenoning car sills and doing the heaviest work with great ease and rapidity. The company have recently completed a machine of this class for working oak timber 16 inches square, cutting a double tenon 8 inches deep at one cut. A companion machine to this is the rotary car mortising machine, which works mortises 12 inches deep, 15 wide, and any length required, the timber being moved by power, and the whole operation almost automatic.

Upon the fourth floor is the "machinist room." This is similar to the second, but engaged on a lighter class of tools, with one exception—the inside head moulder, which is one of the finest tools in use. It weighs 3,500 pounds, and works moulding up to 12 inches wide, and by special adjustments is capable of producing 50,000 feet of narrow mouldings per day, a feat said to be unequaled by any other machine. Among the other tools are: iron frame tenoning machines, whose advantages consist in great facility of adjustment and ease of operation; upright shaping machines, five sizes; boring machines, one ingenious two-bit machine for cabinet work, cabinet jointers for piano work, Reidy's patent ironing and mangling machine, a specialty recently introduced into this country by an English patentee, its peculiarity being the method of heating the roll by a combination of gas and air. Last, but not least, in one corner, occupying but little space, is the manufacture of Boardman's barbed blind staple, which was invented by an employé of the house, and has been made by them for over twenty years. Here several machines are running constantly, for some time past night and day, to produce these little articles, 2,200 of which weigh but a pound, and of which orders have been received within three months for upward of forty tons. It would seem the work of a lifetime to produce such an amount, but the machines are tireless, and, like "Oliver Twist calling for more"—wire—they consume it in their insatiate maws, and the finished staples drop from them like the rain drops.

The three upper floors of the main wing are filled with finished tools ready to be shipped out on order, and the long lines of machines in dozens or half dozens of a kind make a fine display. On the third floor of this wing, a light, pleasant room, with a fine view of the river, is used for draughting the many new designs and improvements required in the business. Something in this line is in process constantly. One of the most recent is the large hub mortising machine, shown in the right hand cut of our illustration. This was produced on a requirement for a machine to mortise a hub 16x18 inches, a task as yet unaccomplished. The machine shown does the work successfully, mortising 8 inches deep in solid hard wood, and although very heavy and powerful—weighing 3,500 pounds—with as much ease to the operator as one of the lighter door mortisers.

This house have always given special attention to perfecting machines for specially difficult classes of work. Complete sets of machinery for making lead pencil woods and finishing the pencils were perfected by this house and furnished to the Messrs. Faber and others. Machines for making meat skewers, turning them out by the million, and many other specialties have been produced, it being only necessary to state the work to be done and something will be invented to meet the emergency. This company work their iron from the pig, the castings being produced in their foundry, of which an interior view is given. It has about 15,000 feet of floor space, two cupolas—one of seven tons capacity, large core ovens, cranes, and every facility for doing a large quantity of work. The present production is from three to four tons on alternate days. The quality of iron is an important item in this class of tools, and the company are able, by making their own castings, to insure the best. Attached to the foundry is the pattern house, 30x15 feet, two stories, and packed to overflowing with the patterns used.

The offices of the house are in the second wing of the works, fronting the street. Here are the accounting department, the correspondence which is extensively carried on with all parts of the world, and in addition to these is a constant production of catalogues, cuts, and circulars descriptive of the various machines. A catalogue is issued frequently of 175 pages, giving full information relative to the 125 different machines made by the house, among which are tools embracing in their ranges of work house building, sash and door, furniture, cabinet and musical instruments, wheels and wagons, railway cars and coaches, to which class special attention is given, planing mills, lumber producers, mouldings and picture frames, brooms, curtain rolls, and in fact for nearly every purpose to which wood is applied. The house has a wareroom at 109 Liberty street, New York, and their shipments extend to Great Britain, France, Germany, Sweden, Austria, Russia, Australia, New Zealand, South America, and every corner of North America, and in nearly every country named the house has a wareroom with machinery in stock.

The machines have been exhibited at every exhibition of note from the Crystal Palace down to the present time, and over 100 medals in gold, silver, and bronze attest the competitive merit of the exhibits.

The present officers of the company are: Lyman Gould, President; R. M. Ladd, Treasurer; and B. H. Rogers, Secretary and Superintendent.

Correspondence.

Electrical Generators.

To the Editor of the Scientific American:

It would seem that the authors of books and chapters on electricity are largely culpable for the numerous discussions which have appeared of late in the SCIENTIFIC AMERICAN on electrical generators. The problem to find the maximum current with a given lot of battery cells and external resistance is well known; also the answer to it, viz., internal resistance equal external resistance. But the other problem, viz., to find, with given external resistance, the number and arrangement of cells, for procuring a given current with a minimum consumption of zinc, seems to be far less common in books, and perhaps generally, though the result may often be of far greater importance.

To illustrate, suppose that in some electro-plating establishment a plating bath is so run as to offer about constant resistance to current; and suppose a certain standard constant current is preferred. If these conditions can be realized by one arrangement requiring $25 greater outlay in first cost for increasing the number of cells, whereby a saving of $50 a year for zinc is realized; a party, expecting to run for years, would be quite likely to adopt the greater first cost.

What is true in consumption of zinc in batteries will be true, in some measure at least, in dynamo-electric machines, because the zinc consumed in one case represents energy, and so do the foot pounds consumed in the other. Hence, for simplicity, batteries are here considered instead of machines.

That for a given external resistance a given current strength may be maintained by different arrangements of cells in rows, the total number of cells varying as required, is evident from considerations of Ohm's law. For instance, if 100 cells in 5 rows satisfies a certain current and resistance, the same effect may be secured with 10 rows of batteries, though 40 or 60 cells may be necessary. It may happen, however, that a large percentage of zinc will be saved with the 60 cells and 10 rows.

The energy of a current is stated, on good authority, to be proportional to the zinc consumed in a well conditioned battery; also, it is proportional to the electro-motive force multiplied by the current strength. These facts applied so as to bring about the relation between the zinc consumed in different cases will show that *for the same external resistance the weight of zinc consumed in a battery arranged for maximum current; divided by the weight of zinc consumed in a battery by like cells in greater number for an equal current, is simply equal to the number of cells in one row of the first battery, divided by the number of cells in one row of the second battery.*

Also for the relation of numbers of cells, it will be found that the ratio of the number of cells in one row, 1st battery and 2d, added to the ratio of number of rows, 1st battery and 2d, is equal to 2; also, the maximum value of this 1st ratio can never be greater than 2.

An example will serve to fix the ideas: Let the cells of battery considered be all alike, with equal electro-motive forces, and the internal resistance of each equal 1 ohm, let the external resistance equal 4 ohms. If the number of cells be 144, arranged in 24 rows of 6 each, we have the maximum current for the cells of resistance named. Again, if 192 like cells be arranged in 12 rows of 16 each, we will have the same current strength, though the total internal resistance of the 2d will be only a third of the 1st.

According to the rule above, the consumption of zinc in the 1st battery will be 50 per cent greater than in the 2d.

Hence it appears that the best arrangement of a battery of several cells for maximum of current is one thing, while the best number and arrangement for securing a given current with a minimum of zinc is quite another. The quantity of zinc diminishes with internal resistance.

From the fact that zinc consumption in a battery stands for about the same thing as foot pound consumption in the dynamo-electric machine, it would seem that for the minimum of power the internal resistance of the machine should be reduced to as small a fraction of the whole as possible, the size of the machine and conditions of working being, of course, consistent with the given current required.

S. W. ROBINSON.

Dep. Phys. and Mech. Eng., Ohio State University.

HINTS TO THE YOUNG STEAM FITTER.

BY WM. J. BALDWIN.

HEATING SURFACES.

All radiators, box coils, flat coils, plate or pipe surfaces, arranged to warm the air of buildings, are heating surfaces.

The vertical tube radiator is now the accepted type of a first-class heater, and most all manufacturers have their own peculiar style with varying results as to efficiency, and the steam fitter or purchaser should use great caution in the selection of radiators.

The common return-bend-radiator, Fig 1, is the most widely manufactured; it is not patented, and is second to no other vertical tube heater.

The construction is simple, a base of cast iron, A, being simply a box without diaphragms, with the upper side full of holes, about $2\frac{1}{2}$ inches from center to center, tapped right-handed; a pipe, B, for every hole, 2 feet 6 inches or 3 feet long, threaded right and left handed, and half as many return bends, C, as there are pipes tapped left-handed.

The manner of putting these heaters together is to catch the right-handed thread of two pipes one turn in the base, then apply the bend to the upper and left threads of the same two pipes, and screw them up simultaneously with a pair of tongs on each pipe, and a second person holding the bend with a wrench made for the purpose.

It will remain in the radiator, impairing its efficiency and often deceiving the novice, as it in time heats by contact with the steam; but when there is a thumb cock or air valve on the radiator, usually on the furthermost pipe from the inlet, the result is quite different. In the common return-bend radiator and others of good construction the action is direct, and the pipes heat consecutively, excepting, perhaps, the pipe the air valve is on and a few near it which sometimes heat ahead of their order, on account of the draught of the air valve

Thus when the steam enters a well constructed radiator the air falls to the base and is driven out at the air valve, the pipe of which may be run down inside the base (as seen at D, Fig. 1), which will bring it into the lower stratum, drawing it off to the last.

This is the most simple test for a good heater, and any make of radiator that nearly always has a few cold pipes, sometimes in one part of the heater and sometimes in another, should be avoided.

Fig. 2 shows a device (patented) for making a return bend radiator positive. The pockets, A A, filling with condensed water, makes a seal which at times prevents the flow of steam along the base and forces it in a continuous stream through the pipes (see arrows in cut).

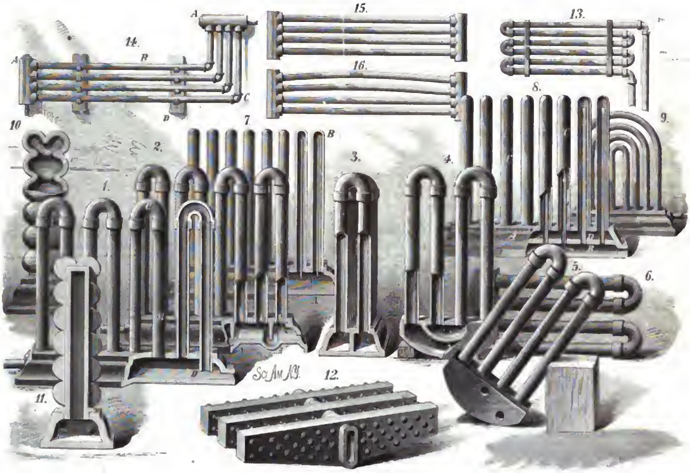
Figs. 3 and 4 show cross section of modifications of positions of the outside, as in Fig. 10, and all wrought iron heaters. Extended surface is understood w the outside surface of the heater is finned, corrugated, or serrated, with the inside straight, as in Fig. 11.

For direct radiation where the heater is place 1 the room there is little or nothing gained by having the surface of the heater extended, and a steam fitter in calculating the extent of his heating surfaces should not take into consideration the whole outside surface of such a heater; he should simply treat it as if the projections were cut off, leaving a flat or plane surface.

For indirect heating (the coil to be under the floor or in a flue) the result is a little different when in comparison with shallow plane surface coils, where the air cannot stay long enough in contact with them to get thoroughly warmed, but presses into the room without hinderance. In this case the extended surface gives a better result, not because a square foot of the surface can transmit as much heat in the same time, but because it hinders the direct passage of the air, holding it longer in contact and preventing stratification.

The cast iron vertical tube radiator is a quick heater, the large size of the tubes causing large and few chambers, which expedites the expulsion of the air.

Fig. 12 shows stack of cast iron extended surface radiators for indirect heating.



Steam fitters who buy bases and make only a few radiators to keep the boys at work when in the shop, should count each set of threads in, but they who make for the trade gauge their threads and pipes so as to always enter the base first. If the pair of pipes in any one bend are not plumb, screw the pipe at the side from which they lean a little tighter; this this will shorten that side and draw the bend over.

I will here explain the action of steam entering a radiator, as nearly all the patents on the so-called positive circulating radiators are to facilitate the expulsion of the air and the admission of steam.

The general impression among steam fitters is that when steam enters a radiator the air is backed up and confined in the top of the pipe, and so it will be when the pipe is single and closed at the top, without any of the usual means to get i down; *this is so*, although steam is not quite one-half the weight of air, and it may seem an anomaly to the scientific engineer.

When two pipes are connected at the top with a bend, or when there is an inside circulating pipe or diaphragm of sheet iron slipped into it, the air immediately gives way and falls in the pipes nearest the inlet first; but should there be no air valve on the radiator, the air will be crowded at first to the further end of the radiator, and should the system be a gravity circulation, without an outlet to the atmosphere, tive return bend radiators. Fig. 3 can be used as a vertical radiator only, but Fig 4 can be used in any position from perpendicular to horizontal, as seen at Figs. 5 and 6, and is peculiarly adapted to indirect heating

Single tube radiators welded, or closed at the top with a cap, with an inside circulating device, are also much used; some of them compare favorably with the return bend radiator, but are slower in heating.

Fig. 7 shows the first of this class put on the market. A is the cast iron base, B the welded tube, and C the septum of wrought iron slipped inside the tube and projecting an inch into the base. This heater depends on the gravity of the air for a circulation

Fig. 8 shows another heater of this class which is positive in its action. A, cast iron base; B, diaphragm cast in base; C, welded tube; D, inside tube, open top and bottom and screwed into the diaphragm. The action of the steam can be seen by the arrows.

Fig. 9 shows a fire bent tube radiator very positive in its action.

Cast iron radiators are of two kinds, *plane* and *extended* surfaces.

Plane surfaces, as the trade understands them, may be either flat round, or corrugated, provided the coring or inside surface of the iron corresponds and follows the indenta-

Sheet iron radiators are used in very low-pressure heating, the commonest form of which is the flat Russia iron heater, seamed at the edges and studded or stayed in the middle, with a space of about $\frac{3}{8}$ of an inch between the sides. They are used in a one pipe job.

COILS.

Coils are always made of wrought iron steam pipe and fittings, and though not considered an ornament are first-class and cheap heaters.

Fig. 13 shows a *flat coil*, which is a continuous pipe connected with return bends at the ends and strapped with flat iron, which is a very positive heater.

Fig. 14 shows a miter or wall coil. It is composed of headers or manifolds, A A; steam pipes, B; elbows, C; and hook plates, D.

There are many modifications of this coil, but one indispensable point in the making of it is, it must *turn a corner* of the room or miter up on the wall. The pieces from the elbows to the upper header are called *spring pieces*, they are screwed in right and left, and are the last of the coil to be put together.

If a coil is put together straight between two headers, as seen at Fig 15, it will be like Fig. 16 when heated, and cannot be kept tight for a single day, the expansion of the first pipe to heat being a powerful purchase to force the

benders asunder, and when it cannot do so it will spring them sidewise.

TO ESTIMATE THE AMOUNT OF HEATING SURFACE NECESSARY TO MAINTAIN THE HEAT OF THE AIR OF INCLOSED SPACE IN BUILDINGS TO THE DESIRED TEMPERATURE.

The ordinary rule-of-thumb way of the average pipe fitter is to multiply the length by the breadth of a room and the result by the height, then cut off two figures from the right hand side, and call the remainder square feet of heating surface, with an addition of from 15 to 30 per cent for exposed or corner rooms.

In the computing of heating surfaces there is much more to be considered, and it is evident the amount of surface necessary for a good and well constructed building will not be enough for a cheap and poorly put up one.

The cubical contents of a room occupies only an inferior place when estimating for large rooms and halls, and no place at all in figuring for small or ordinary office rooms or residences, which are heated from day to day throughout the winter.

Suppose a small room on the second floor of a three story building with only one outside wall, with no windows, but the whole furred, lathed and plastered, with all the other ro[illegible] the building heated and maintained [illegible] Fah.; now place a portable heater in the room and keep it there until [illegible] heated to 70° also, then remove [illegible]; will it take to cool 10°? Answer, perhaps three hours. Now make a window without blinds, and you find it cools 10° in less than half the time. Why? Because the glass of the window being a good transmitter of heat, it is able to cool more air than the whole outside wall. You may now say: What about the inside walls and floor? Why, they actually help to maintain the heat in the room by conduction, etc., from the other rooms.

Thus the windows are the first and most considerable item. Secondly, the outside walls, how they are plastered—whether on the hard walls or on lath and furring. Thirdly, the prospect—whether exposed or sheltered. Fourthly, is the whole house to be heated, or only part of it? and, lastly, what the building is to be used for.

TABLE OF POWER OF TRANSMITTING HEAT OF VARIOUS BUILDING SUBSTANCES, COMPARED WITH EACH OTHER.

Window glass	1,000
Oak and walnut	66
White pine	80
Pitch pine	100
Lath and plaster	75 to 100
Common brick (rough)	100 to 130
Common brick (whitewashed)	125
Granite or slate	150
Sheet iron	1,030 to 1,110

In figuring wall surface, etc., multiply the superficial area of the wall in square feet by the number opposite the substance in the table, and divide by 1,000 (the value of glass), the product is the equivalent of so many square feet of glass in cooling power, and may be added to the window surface and treated the same.

The following method has given good results and is not wholly empirical. The writer has used it for many years in preference to any other:

Divide the difference in temperature between that at which the room is to be kept and the coldest outside atmosphere, by the difference between the temperature of the steam pipes and that at which you wish to keep the room, and the product will be the square feet or fraction thereof, of plate or pipe surface to each square foot of glass or its equivalent in wall surface.

Thus: Temperature of room, 70°; less temperature outside, 0°; difference, 70°. Again: Temperature of steam pipe, 212°; less temperature of room, 70°, difference, 142°. Thus: 142÷70=0.493, or about one half a square foot of glass-heating surface to each square foot of glass or its equivalent. For each additional mile and a half in the average velocity of the wind above fifteen miles per hour add ten per cent to the heating surface.

In isolated buildings exposed to prevailing north or west winds there should be a generous addition of the heating surfaces of the rooms on the exposed sides, and it would be well to have it in an auxiliary heater, to prevent over-heating in moderate weather.

In windy weather it is well known to the observant that the air presses in through every crack and crevice on the windward side of the house; and should they take a candle and go to the other side of the house they will find that the flame of the candle will press out through some of the openings. Thus the air in a house blows in the same general direction as the wind outside, and forces the warmed air to the leeward side of the house; this is why the sheltered side of a house is often warmer in windy weather.

Conditions which tend to the warmth of a house in windy and cold weather without stopping the leakage of air under doors or around windows are: 1st, blinds on the windows inside; 2d, blinds on the windows outside; 3d, window shades and curtains; and, last, papered walls. The leakages are really blessings in disguise in houses which are not systematically ventilated.

Lead or zinc paint should not be used on heaters; several coats of lead paint may destroy their heating power from fifteen to twenty per cent. Ocher and oil, or varnishes mixed with color, are the least harmful.

CLOCK OF AUSTRIAN DESIGN.

A NOVEL CLOCK.

On this page we illustrate a handsome clock of Austrian manufacture, which makes no pretense of being anything other than what it is, and in which the design and ornament are studied with due reference to the use for which it is intended. The simplicity of the design is offset by elaborateness in the detail of the decoration, which is rich and well conceived. In the panels of the dome is some very fine work. Above the dome is an open belfry, containing a bell and hammer. With this arrangement the vibration of the metal, when the hours are struck, is not muffled, but rings out clearly and with distinctness. Another feature, companionable or distracting, according to one's mood, is the pendulum swinging across the face of the dial, attracting the eye by its mute motion to the ever-advancing hands and to the significant legend inscribed above them.

THE AARD VARK.

The aard vark, or earth hog, is a native of Southern Africa, and is a very curious animal. The skin of the aard vark is not protected by scales or plates like those of the

AARD VARK.—*Orycteropus Capensis.*

manis and the armadillo, but rather thinly covered with coarse bristly hair. Its length is about five feet, the tail being twenty inches long, and it is a very powerful creature, especially in the fore limbs, which are adapted for digging, and are furnished with strong hoof-like claws at their extremities. These claws can be used with marvelous rapidity and force, and are employed for the purpose of destroying the dwellings of the ants on which the aard vark feeds, as well as for digging a burrow for its own habitation.

The burrows are not very deep, but are of tolerably large dimensions, and are often used, when deserted, as extempore tombs, to save the friends of the deceased from the trouble of digging a grave for their departed comrade. The creature makes its burrows with marvelous rapidity, and can generally dig faster with its claws than a man with a spade.

The aard vark is a nocturnal animal, and can very seldom be seen during the day time. At night it issues from its burrow, and making its way toward the ant hills begins its work of destruction. Laying its fore feet upon the stone like walls of these edifices, the aard vark speedily tears them down, and as the terrified insects run about in the bewilderment caused by the sudden destruction of their tenements, it sweeps them into its mouth with rapid movements of its long and extensile tongue. This member is covered with a tenacious glutinous secretion, to which the ants adhere, and which prevents them from making their escape during the short period of time that elapses between the moment when they are first touched and that in which they are drawn into the mouth.

Trapping Rats.

A Wisconsin correspondent of the New York *Tribune* gives the following mode which he has successfully adopted:

Having lured to destruction many old Solomons among rats, I will detail my plan: Take a pan nearly full of bran, set a small steel trap without any bait, put a light wad of tow or cotton under the pan of the trap, which press down so it is just ready to spring; put the trap in the bran, making a place with the hand, so that it may be below the surface when level; lastly, scatter a few kernels of corn on the bran (pumpkin seeds are better), and you are ready for your victim. I hardly ever fail to fool some of the ringleaders in this way, while younger ones are easily caught. If "P." cannot thus circumvent that shy and cunning old specimen, I will give him my plan with strychnine, which is as swift with rats as with dogs.

So much for the Wisconsin rats. We cannot but think that the "old Solomons" out there are not half so wise or cunning as some we have encountered at the East. Some years ago the rats made bad havoc in our cellar, and we resolved to try the efficacy of the steel trap. It was set in a large flat vessel, and well covered and hidden with bran. We were more cautious than the writer above, for we used a large spoon to move the bran, fearing the rats might smell the touch of fingers and keep away. Small bits of cheese were then dropped over all parts of the bran and over the covered trap. The next morning there were tracks of rats all over the surface, *except where the trap was buried;* and the cheese was all taken, except directly *over the trap*. We were compelled to resort to a more effectual trap, which proved quite successful—in the shape of a fine old tom cat.—*Country Gentleman.*

New Fossil Reptiles from the West.

The Yale Museum has recently received numerous remains of reptiles from the Jurassic deposits of the Rocky Mountains, and some of the more interesting dinosaurs are briefly described and figured by Prof. O. C. Marsh, in the current number of the *American Journal of Science and Arts*. These reptilian remains pertain to several distinct groups, and are interesting from the fact that they throw considerable light on the forms which have already been described from the same horizon.

Most of the animals described in the present communication belong to genera hitherto unknown. Of these new genera, the first (nearly allied to *Laosaurus*), which is called by Prof. Marsh *Camptonotus*, contains, as far as known, two species. *C. dispar* appears to have been a reptile about 8 or 10 feet in length, and herbivorous in habit. The fore limbs of the animal were much reduced in size; the massive portion was not in front, but behind, the ischium being larger than the pubis. All the specimens discovered are from the Atlantosaurus beds of the Upper Jurassic. The other species of this genus, *C. amplus*, was about three times as large as the one just mentioned, and is represented in the collection by various remains, among which is a left hind foot nearly entire.

Brontosaurus excelsus (new genus and new species), one of the largest reptiles yet discovered, has been recently brought to light, and a portion of its remains are now in the Yale collection. This monster, which was probably 70 or 80 feet in length, apparently belongs among the *Sauropoda*, but differs from any of the known genera in several important respects. The sacrum of the animal was 4 feet 3 inches in length, but had the striking peculiarity of being comparatively light, owing to the extensive cavities in the vertebræ, the walls of which were very thin. The remains of this gigantic reptile were discovered in the Atlantosaurus beds of Wyoming. Additional specimens of *Stegosaurus*, including a new species (*S. ungulatus*) have been recently secured, and much new information in regard to the group has thus been obtained. These reptiles belong to the dinosaurs, but differ widely from any of the known sub-orders. The most striking character, to which the name refers, is the huge dermal plates which served to protect the animal. A number of these, from 2 to 3 feet in diameter, and others of smaller size, were found with the remains of the present species. The skull is very small, and more lacertilian than in the typical dinosaurs, and the brain cavity is remarkably small. The vertebræ known are all solid, and the fore limbs of the animal are shorter than those behind.

Coelurus fragilis (new genus and new species) was a very small reptile, apparently a dinosaur, which left its remains in the same locality with *Camptonotus dispar*. The most characteristic specimens that have been obtained are vertebræ. Judging from what is known of the remains of this species, the animal appears to have been about as large as a wolf, and probably carnivorous in habit.

Human and Canine Blood Corpuscles.

The question whether it is possible to distinguish between dog's blood and man's blood by microscopic measurements of their respective corpuscles was pretty strongly negatived by the evidence given in a noted murder trial by Dr. Woodward, of the Army Medical Museum at Washington. Dr. Treadwell, of Boston, had previously testified, in the same case, that he had identified certain blood stains on a pocket-knife as human blood by means of such measurements. Dr. Woodward, on the other hand, contended that such identification was impossible.

The corpuscles of the blood of man and dog vary within very wide limits, and corpuscles vary according to the health of the individual; a French investigator had discovered some in persons afflicted with anæmia as large as 1-331 of an inch; another 1-500; however the witness had never found one so large, his experiments giving measurements from 1-2500 to 1-4500; the corpuscles of dog's blood vary little from those of man's, but the largest or smallest sizes are not always to be found in any single drop from any animal; it has been claimed that there was no difference in the corpuscles of young or old; but Perrier, of Bordeaux, wrote in 1877 that the two extremes of size disappear as age advances and the corpuscles become uniform. Dr. Woodward had investigated this theory so far as it applied to man and the dog, and believed it correct; this applies to age; the variations caused by disease are yet an open question. Between the extremes all measurable sizes exist, varying even to millionths of an inch, the corpuscles in a drop of blood varying as much in size as different men do in a throng. Therefore when you try to get an average from four corpuscles or fifteen corpuscles you cannot do it any more than you can get the average size of men in a throng by measuring a few of them. Therefore it has happened that scientific men in their investigations do not get results comparing with each other; a noted investigator, Mr. Gulliver, in 1848 stated that the average size of man's corpuscles was 1-3200 of an inch, but Pelius and Franle, French investigators, found them slightly larger, and other Frenchmen found them smaller; what varies in nature must, of course, vary in the results placed upon paper, continued the witness, who admitted that he had never been able to get the same results from measurements of the corpuscles in two different drops.

At this point the witness referred to a paper written by him in 1875 for the *American Journal of Science*, and giving thirteen sets of measurements of human corpuscles; those of each set of 50 were averaged, he said, and the average of the aggregate was 1-3500 of an inch. These figures he had since criticised in print as being not absolutely correct, yet many European authorities still agree with them. Continuing, he remarked that as a drop of blood contains between five and six million corpuscles, in endeavoring to identify blood one must think of how many drops there are in a human body, and consequently how many millions of corpuscles. Hence we see how impossible it is to identify blood by measuring fifty corpuscles.

In reply to a question as to the relative sizes of dog's blood and human blood, Dr. Woodward detailed some recent experiments. One with forty corpuscles of the blood of one of his assistants in the Medical Museum in Washington, showed an average of about 1-3038 of an inch. Fifty corpuscles of dog's blood averaged only one millionth of an inch from the average of the forty of human blood above described. Upon the subject of restoring to their normal size for measurement the corpuscles of dried blood, Dr. Woodword said that there were numerous difficulties which tended to prevent accurate work. When restored they are generally smaller than their normal size, and would therefore appear to come within the ranges of the corpuscles of other species; the best restorative is that nearest approaching the serum of the blood, and that is the embryotic fluid surrounding the fœtal calf; glycerine with water gives good results in careful hands.

In reply to the question whether other diseases than anæmia affected the size of blood corpuscles, Dr. Woodward said: A statement is going the rounds of medical literature that all fevers do; however, one of my colleagues has examined the blood of a person who died of yellow fever and found no difference. The fifteen corpuscles discovered by Dr. Treadwell and testified to in the case under trial were within the range of human blood corpuscles, but they were also within the range of dog's blood.

Said the counsel: "You don't agree absolutely, doctor, with any of the line of eminent experts of Europe or America who were mentioned this morning?" A. "No, sir, for my own averages of measurements can never be made to agree."

"Why?"

"Because of the differences of the things measured—the corpuscles."

The Most Northern Point of the United States.

BY WILLIAM A. MOWRY.

If the question were asked, Which is the most northern part of the United States, excepting Alaska? perhaps many would say, The line of 49° from the Lake of the Woods to the Strait of De Fuca. But that answer would be incorrect. There is a point where the United States reaches 49° 23′ 54″ north latitude. It is in longitude 95° 14′ 38″ west from Greenwich.

In other words, at the Lake of the Woods, in Minnesota, our territory includes a small area reaching beyond 49° more than 25 miles. This little excrescence, jutting out into British America, is recently put down upon some of our maps, but I have not seen it on many of them. It is indicated, though roughly, upon Case's large map of the United States and upon the large map published by the Government and issued by the Land Office. I observe it also in Warren's School Geographies.

The map which shows it most accurately is perhaps the Map of the State of Minnesota, published by the St. Paul Book and Stationery Company, at St. Paul. On most of the maps the Lake of the Woods is by no means correct, or even approximately so.

After learning the fact that our country does hold this little jutting piece of both land and water, the question arises, How did it happen that the boundary should take this circuitous direction? The answer is as follows: In the definitive treaty of Paris, signed (September 3, 1783) by John Adams, David Hartley, Benjamin Franklin, and John Jay, Article II. defines the boundaries of this country. In this article we find that from Lake Superior westward the boundary is given as follows:

"Thence through the middle of Long Lake and the water communication between it and the Lake of the Woods to the said Lake of the Woods; thence *through the said lake to the most northwestern point thereof*, and from thence in a due west course to the river Mississippi."

Evidently it was then supposed that the source of the Mississippi was to the north and west of this point. When, however, it was subsequently ascertained that the headwaters of this river were to the southward, the line was made to run from this "most northwestern point of said Lake" due south to latitude 49°.

We next find allusion to the matter in the treaty of "Amity, Commerce, and Navigation," signed at London (November 19, 1794) by Grenville and John Jay. The 4th Article proposes that, "Whereas it is uncertain whether the river Mississippi extends so far to the northward as to be intersected by a line to be drawn due west from the Lake of the Woods," measures shall be taken "to make a joint survey," and "the two parties will thereupon proceed to amicable negotiation to regulate the boundary line in that quarter."

By the 7th Article of the treaty of Ghent it was agreed to refer to commissioners "the boundary line from Lake Superior to the Lake of the Woods." In 1827 the commissioners made their final report, with maps of actual survey from Lake Huron to the Lake of the Woods. In this report they say:

"The extreme northwestern point of the Lake of the Woods is declared to be at lat. N. 49° 23′ 54″ and lon. W. 95° 14′ 38″; so that in conformity with the treaty this point, having been ascertained to be north of parallel 49°, a line is drawn due south from it to parallel 49°, on which parallel it is to be continued to the Rocky Mountains. No means have yet been taken to delineate the boundary westward from the Lake of the Woods."

The commissioners were Peter B. Porter and Anthony Barclay. No change was made from these agreements by the "Webster Ashburton Treaty" of 1842.

It is to be hoped that all future school geographies and larger maps will show this boundary.—*N. E. Journal of Education.*

The Red Spot on Jupiter.

Recent communications to the *Astronomische Nachrichten* give further interesting details of the large, oblong red spot which may at present be seen so conspicuously on the southern portion of Jupiter's disk. According to Th. Bredechin, of Moscow, it is 16 seconds of arc long and 4 seconds broad, and lies about 9 seconds south of Jupiter's equator. It is surrounded with very brilliant white faculæ, which are especially conspicuous on its southern border.

According to Dr. Lohse, who has observed the spot since last June, it appears to lose in a considerable degree its intensity and color when near the planet's limb. He also sees the faculæ, spoken of above, and remarks at the preceding end of the spot a sort of grayish continuation, resembling in form an inverted comma.

This spot has not apparently diminished in intensity or size during many months—a fact which indicates considerable stability. As there is considerable probability that it will be visible another season, Dr. Lohse suggests that observations of its position will afford very valuable data for an accurate determination of Jupiter's rotation period. The sharpness of outline and regularity of form of the spot admirably adapt it for this purpose. The position of the spot

should be fixed by estimation, its distance from the planet's limb being expressed in parts of the parallel of latitude passing through the spot, that is, in parts of the chord of the planet's disk drawn through the spot parallel to Jupiter's equator. Either end of the spot may be used for this purpose. The estimation made when the spot is near the center of the disk will be manifestly the most certain.

This is an opportunity that amateurs should not neglect, since the observations can be made with moderate telescopes and without a micrometer.—*Science Observer.*

Fast Railway Speeds.

The speed of railroad trains in France, Germany, and the United States is still below that of several lines in England. The "lightning train" on the Paris-Marseilles line makes the distance of 539 miles between these two cities in 15 hours and 21 minutes, the average speed, including stoppages, being 35 miles an hour. The express train on the Lehrter Railway runs from Berlin to Cologne at the rate of $37\frac{1}{2}$ miles an hour, including stops, making the entire distance of 364 miles in 9 hours and 36 minutes. The Scottish mail leaves Euston Square at 8:50 in the evening and reaches Edinburgh at 6:45 the next morning. The distance is 401 miles, the time 9 hours and 55 minutes, the rate of speed, including stops, $41\frac{1}{3}$ miles an hour. The express from King's Cross runs to Edinburgh, a distance of 397 miles, in $9\frac{1}{2}$ hours, or at the rate of 42 miles an hour, including stops. The fast train from Paddington to Plymouth, and the Irish mail from London to Holyhead, average between 41 and 42 miles an hour, or about the same as the Scottish trains. The fastest short-distance trains in Germany are that which runs from Spandau to Stendal, $57\frac{1}{2}$ miles, without stopping, in 1 hour and 17 minutes, or at the rate of 45 miles an hour, and the express, which makes the distance of $89\frac{3}{4}$ miles, between Berlin and Magdeburg, in 2 hours and 7 minutes, or at the rate of 42 miles an hour, including two stops. In England a much higher rate of speed is attained on short distances. The Great Western trains run through from London to Swindon at the rate of 53 miles an hour, making the entire distance of $77\frac{1}{4}$ miles in 1 hour and 27 minutes, while nearly 50 miles an hour is made by the special express, which runs from London to Wantham, 105 miles, in 2 hours and 5 minutes. This is doubtless a much higher rate of speed than the usual schedule time on roads in the United States. The Washington limited express leaves New York at 10 A.M. and reaches Washington at 4 P.M. The distance, 230 miles, is made in 6 hours, or at the rate of 38 1-3 miles an hour, including stops. Between New York and Philadelphia but two stops are made, the rate of speed is 40 miles an hour. The Boston express, which leaves New York at 11 A.M., runs to Boston, 231 miles, in 7 hours and 11 minutes, which is about 32 miles an hour, including the six stops that are made. The special mail and express train on the New York Central and Hudson River road makes the distance at night between New York and Albany, 143 miles, in 4 hours and 5 minutes, or nearly 36 miles an hour. Only one stop is made. The Cincinnati express on the Pennsylvania Railroad leaves New York at 6 in the evening and reaches Pittsburg, a distance of 444 miles, at 8:30 on the following morning, and Cincinnati, 757 miles, at 8 P.M. of the same day. The rate of speed, including stops, is about 30 miles an hour between New York and Pittsburg, and 29 miles an hour between New York and Cincinnati. The distance between Harrisburg and Pittsburg, 249 miles, is run in 7 hours and 35 minutes, with three stops, or about 33 miles an hour. The fast line to Chicago by way of the Pennsylvania Road leaves New York at 9 A.M., and reaches Chicago at 7:20 on the following evening. The distance is 912 miles, the time 34 hours and 20 minutes, the rate of speed less than 27 miles an hour.

Silk Woven Pictures.

It would almost seem that silk weaving has attained perfection in the marvelous pictures woven in silk by Mr. Thomas Stevens, of Coventry. Elegant designs in Coventry ribbons are familiar to all, many beautiful examples having won general admiration, but none excel the dainty silken pictures woven by Mr. Stevens' process. These pictures are comparatively small, and the subjects chosen are popular. Specimens may be seen in the shops of many stationers, and they form not only pretty but most unique and interesting wall decorations. Four subjects we have noticed illustrate the old stage coach, with horses, driver, guard, passengers, and luggage complete, and, in contradistinction to the primitive mode of traveling, there is the original locomotive engine, or "Puffing Billy," which laid up the old stage coach as a public conveyance, and terminated the "good old coaching days." A race for the blue ribbon of the Turf is vividly portrayed in silk, as is also "Dick Turpin's Ride to York." The specimens shown us were woven in the machinery department of the Fine Art and Industrial Exhibition held at York. These silk pictures are made in the largest known loom of its kind in the world—an admirable machine, which has taken medals at every exhibition wherein it has been shown, including the Philadelphia Centennial Exhibition, where, among thirty others (of all nationalities), it secured first prize. This extraordinary mechanical contrivance contains 160 shuttles, and will weave patterns in from eight to sixteen colors. The four subjects above mentioned contained ten and twelve colors, and it may be interesting to know that the pattern takes 5,000 perforated cards and 600 threads. As the loom makes twenty pictures at a time there are no fewer than 12,000 threads at work. A knowledge of these facts tends to make the Stevensgraph still more interesting, and demonstrates the vast amount of thought and labor entailed in the production of pretty silk pictures, sets of which are very suitable for Christmas presents and New Year's gifts.—*British Trade Journal.*

Stereoscopic Pictures.

Professor Steinhauser, of Vienna, has recently pointed out that there exists a determinate relation between the size and relative position of the two views of a stereoscopic picture, the lenses of the camera with which it is taken, and the optical arrangements of the stereoscope in which it is to be viewed. If these relations are observed rightly, the effect of relief will be much more perfectly attained for all parts of the picture than if they are neglected. The eye pieces of the stereoscope above the plane of the photographic pictures ought to be made as nearly as may be equal to the focal length of the objective of the photographer's camera, and this again should be about equal to the mean distance of easy vision, or, from ten to twelve inches. Herr Steinhauser, after developing the theory of the instrument in relation to this point, throws out three very definite and simple suggestions for the photographers. First, that all stereoscopic pictures should be taken with lenses of equal focal length, say five inches; secondly, that all should be made of equal breadth, or about three inches; thirdly, that the distances between the centers of the objective lenses should always be kept constant.

The Okinawa Islands.

These islands have recently become a regular province or *ken* of the Japanese Empire, but are still a subject of serious controversy between Japan and China. Their ancient name was Liu Kiu, which has been corrupted by modern navigators into Loo-Choo, Lew Chew, and Lieou Kieou, and by the present natives into Doo-Choo, but the more musical name of Okinawa was given to them by the inhabitants themselves centuries ago, and the meaning of it is "the cord lying upon the sea." The entire group consists of thirty-seven islands, the largest of which is eighty-five miles long, by from three to twenty-three in width, and has a circumference of one hundred and fourteen *ri*, or about two hundred and seventy-eight miles.

During the whole of the eighteenth century the islands of Okinawa would seem to have remained in a state of perfect tranquillity. They continued to pay a double tribute to Japan and China, and having faithfully done so they felt that they had a right to bring in from abroad any new ideas that they might fancy. Hence they imported the paper mulberry from Japan, and began to manufacture paper; and from China they obtained the secret of making India ink, and also as an article of food when young, and for the beauty of its wood, they imported and cultivated the famous moso bamboo. They also adopted a code of criminal laws and of laws for reward, and not only established a national school, but many local schools in the various districts.

The peculiarities of the inhabitants of Okinawa may be summed up as follows: They are noted for their natural intelligence, though the majority have few opportunities for acquiring the knowledge contained in books; their language is closely allied to that of the Japanese; their occupations are chiefly agricultural, the leading productions being rice, wheat, sugar, millet, sweet potatoes, beans, peas, radishes, turnips, tobacco, cotton, indigo, and flax; their manufactures are limited to cloths made from cotton and grass, to porcelain and lacquered goods, and such other things as are needed for a simple rural population; the men are generally stout, well formed, and fond of wearing beards; the women are small, and kept in a low social position; all classes are industrious and neat in their persons and habitations; their style of dressing is Oriental, and suited to the climate; their homes are comfortable and picturesque; the table and household customs are similar to those of the Japanese; in religion they are generally Buddhists, although some of their rites are peculiar to these islands.

They know not what it is to have an army, nor any such offspring of civilization as a political demagogue; their policy is to carry on their public affairs in a spirit of courtesy and kindness. When they have deemed it necessary to carry guns on their little vessels, they have borrowed them from Satsuma. They use the Japanese alphabet, and write after the manner of their neighbors and protectors; and in speaking of their language they claim that six tenths of the words are Japanese, three-tenths a local dialect, and one-tenth Chinese. When any public business is to be transacted, the people are called together in their several districts, and the men in authority accomplish the purposes of the government by kindly admonitions.—*International Review.*

Production of Phosphorescent Powders.

The patentees of this process (Prince Sagan, W. F. McCarty, and E. Peiffer) employ a mixture of 100 parts carbonate and phosphate of lime (obtained by the ignition of shells, especially *Tridacna* and *Sepia*) with 100 parts quicklime, 25 parts of calcined salt, and 25 to 50 per cent of the whole mass of sulphur; 6 to 7 per cent of a coloring matter—a sulphide of calcium, strontium, barium, magnesium, aluminium, etc.—must then be added. This powder serves to render barometers, compasses, etc., luminous, and is particularly phosphorescent under the influence of an electric current.

Artificial Indigo.

At a recent meeting of the Chemical Society, London, a paper was read "On Alizarin Blue," by G. Auerbach. About eighteen months since a blue coloring matter was brought into the market as a substitute for indigo; it is now disused on account of its high price and its unstable nature when exposed to sunlight. The researches contained in this paper were finished in May, 1878. The author gives a *résumé* of previous work on the subject, and recommends the following method of preparation: 1 part of dry mononitroalizarin, 5 parts of concentrated sulphuric acid, and $1\frac{1}{2}$ parts of glycerine, sp. gr. 1·262, are mixed and heated gently. Reaction commences at 107° C. and becomes violent, the temperature rising to 200° C.; much frothing takes place, with evolution of sulphurous acid and acrolein. The whole mass, when frothing has subsided, is poured into water, boiled up, and filtered, the residue being boiled out three or four times with dilute sulphuric acid. The mixed filtrates are allowed to cool, and the blue separates in brown crystals. These are purified, by mixing with water, and adding borax till the solution becomes brownish violet; the blue with the boric acid forming an insoluble compound. This residue is washed, decomposed with an acid, and the pure blue obtained as a violet silky paste. If required perfectly pure, it must be crystallized successively from its various solvents, high-boiling naphtha, amylic alcohol, and glacial acetic acid. When pure it forms brown shining needles, melting at 268–270°; it has the formula $C_{17}H_{11}NO_4$; salts were prepared and analyzed, but the results were not satisfactory, as it was difficult to obtain them quite pure; bromine derivatives were also prepared and examined. The action of chlorine, zinc dust, acetic anhydride, etc., have also been studied. The author discusses the constitution of the blue, and thinks it must be closely related to the aldehydines discovered by Ladenburg, which are formed when aromatic orthodiamides act upon aldehydes.

Mineral Tanned Leather.

An account of a new process of mineral tanning, patented in Germany by Dr. Chr. Heinzerling, of Frankfort-on-the-Main, was described in the last volume of the SCIENTIFIC AMERICAN, page 234.

Referring to that article, Messrs. Wirth & Co., of Frankfort, write that there are now eight tanneries using this process in Germany, their leather everywhere meeting with approval. The leather is impervious to water, and its durability is said to be much greater than that of leather as ordinarily tanned. For example, a pair of shoes were made, the right with a mineral tanned sole, the left bark tanned. These shoes were subjected to natural wear, and when the left was worn out the right sole was uninjured. Trials made by the spinning mill of Jungst & Co., of Biederkopf, within the past year, showed that belts of mineral tanned leather were not only better, but 30 per cent cheaper, than others. It is worthy of note that this method of Dr. Heinzerling is radically different from Prof. Knapp's method of iron tanning, and presents none of the objections which make the latter unsatisfactory.

Fur on the Tongue.

One of the marked symptoms of certain diseases is a thick coating or "fur" on the tongue. In a recent paper before the British Royal Society, Mr. H. T. Butlin, F.R.C.S., described this fur as consisting chiefly of (1) *Débris* of food and bubbles of mucus and saliva; (2) Epithelium; (3) Masses which appear at first to consist of granular matter, but which are the glœa of certain forms of schistomycetes. That the last named of these three is the essential constituent is proved by the fact that the quantity of the glœa corresponds roughly with the quantity of fur present, and that its position upon the tongue corresponds exactly with that of the fur, both covering the tops of the filiform papillæ, but not usually lying between them. In order to ascertain the true nature of the glœa, and to obtain it in a purer form, it was cultivated upon a warm stage. Several fungi were discovered, but only two of these were present in every instance, *Micrococcus* and *Bacillus subtilis;* and, as the glœa produced artificially was similar to that existing naturally in the tongue fur, it is believed that fur is composed essentially of these two fungi. *Micrococcus* developed freely and abundantly, forming large masses of yellow or brownish yellow color. *Bacillus* did not develop, but existed in greater or less abundance in all the cases examined. Its development was probably prevented by the presence of other developing organisms, from which it was found impossible to separate it. It appeared to be identical with the *Leptothrix buccalis* of Robin. Although it did not develop under artificial conditions, it is probable that development takes place freely upon the surface of the tongue. Its habitual occurrence there and the presence of spore bearing filaments favor this view. Besides these fungi there were present, more or less constantly, *Bacterium termo, Sarcinâ ventriculi, Spirochæta plicatilis,* and a larger form of *Spirillum* (or rather *Vibrio*). *Sarcinâ ventriculi* was frequently present, and generally developed quickly, forming large masses of a yellow or yellowish brown color. *Spirochæta plicatilis* occurred only in two or three of the specimens examined. *Bacterium termo* existed in some of the furs, and twice developed with such rapidity that the whole of the fluid was crowded with these organisms. The slime between and around the teeth was found to consist of the same fungi as the tongue fur, but the rods of Bacillus were longer, probably owing to the disturbing causes being fewer.

Contagion.

Contagion consists physically of minute solid particles. The process of contagion consists in the passage of these from the bodies of the sick into the surrounding atmosphere, and in the inhalation of one or more of them by those in the immediate neighborhood. If contagion were a gaseous or vapory emanation, it would be equally diffused through the sick room, and all who entered it would, if susceptible, suffer alike and inevitably. But such is not the case; for many people are exposed for weeks and months without suffering. Of two persons situated in exactly the same circumstances, and exposed in exactly the same degree to a given contagion, one may suffer and the other escape. The explanation of this is that the little particles of contagion are irregularly scattered about in the atmosphere, so that the inhalation of one or more of them is purely a matter of chance, such chance bearing a direct relation to the number of particles which exist in a given cubic space. Suppose that a hundred germs are floating about in a room containing two thousand cubic feet of air. There is one germ for every twenty cubic feet. Naturally the germs will be most numerous in the immediate neighborhood of their source, the person of the sufferer; but, excepting this one place, they may be pretty equally distributed through the room; or they may be very unequally distributed. A draught across the bed may carry them now to one side, now to the other. The mass of them may be near the ceiling, or near the floor. In a given twenty cubic feet there may be a dozen germs or there may be none at all. One who enters the room may inhale a germ before he has been in it ten minutes, or he may remain there for an hour without doing so. Double the number of germs and you double the danger. Diminish the size of the room by one half, and you do the same. Keep the windows shut, and you keep the germs in; open them, and they pass out with the changing air. Hence the importance of free ventilation; and hence one reason why fever should be treated, if possible, in large airy rooms. Not only is free ventilation good for the sufferer, but it diminishes the risk to the attendants.—*Nineteenth Century.*

New Process of Gilding Glass.

We translate from a late issue of the Dresden *Glashutte*, says the *Pottery and Glassware Reporter*, the following concerning a new chemical process for gilding glass discovered by Mr. Mayan, which will be of interest to our manufacturers of ornamental glassware. The glass, it will be observed, is gilded by bringing it in contact with a bath containing a solution of gold, the composition of this bath conditioning several reactions in order that the gold may settle upon and become firmly attached to the glass. The bath consists of—

1. A solution of gold.
2. A solution of caustic soda.
3. A reagent.

The first of these is obtained by dissolving chemically pure gold in muriatic acid. This solution is then evaporated until a perfect crystallization is secured. The gold crystals thus obtained are dissolved in water in the ratio of six or seven grammes to one liter of distilled water, and filtered until perfectly pure.

For the second solution forty grammes of caustic soda are treated with alcohol or lime, dissolved in one liter of distilled water, so that the solution shows seven or eight degrees of caustic soda. Although a greater or less portion of gold or alkali does not affect the operation materially, the proportions given are those which have proven themselves practically the most economical both in regard to the ingredients and rapidity of the process.

Four fifths of the gold solution and one fifth of the caustic solution are then mixed, and to one liter of this mixture is added one of the reagents in the following proportions:

1. Three cubic centimeters of concentrated and chemically pure glycerine, mixed with the same quantity of distilled water, with the above mentioned caustic solution, form the most energetic reagent.

2. Five cubic centimeters of 90 per cent alcohol mixed with equal parts of glucose solution, the latter being prepared by taking twenty grammes of glucose to 100 grammes of distilled water, and boiling the mixture down to about fifty grammes. This reagent gives the gilding a reddish color.

3. Thirty cubic centimeters of a mixture of 90 per cent alcohol and the following solution of sugar: Dissolve twelve grammes of white sugar in 100 grammes of distilled water, add two grammes of nitric acid of 1·34 specific gravity, and let the whole boil for fifteen minutes. Of this and the alcohol equal weights are mixed.

4. Forty cubic centimeters of aromatic alcohol—butyl, propyl, or amyl alcohol answers the purpose best. This reagent gives the gilding a peculiar brilliancy.

5. Forty cubic centimeters of brandy made of fruit juice or sugar cane.

Although the quantity of the reagent to be added need not correspond exactly with the proportions given above, it is to be understood that certain limits are not to be overstepped. One would, for instance, fail in the operation if, instead of three centimeters of glycerine, twenty grammes should be taken.

The reaction or gilding begins as soon as the different elements of the bath are united. The settling of the gold occurs in every direction, but it can only be used when it acts upward; therefore the article to be gilded must be placed in such a position that the gold will touch the parts to be gilded in the direction mentioned. A glass plate to be gilded, for instance, must be allowed to swim on the bath. No deviation from this rule will be followed by success. As soon as the gilding is sufficiently strong, the article is taken from the bath, rinsed with pure water, thoroughly dried, and coated with varnish. In order to make the gilding more durable, use a varnish made of a glass enamel easily vitrified, or of enamel colors, afterward burning it in a muffle.

A Novel Experiment.

A pretty illustration of the extent to which practical demonstration is sometimes carried in popular scientific lectures was given in the crowded hall of the Cooper Institute, in this city a few evenings since. It was nothing less than the measurement of the velocity of a rifle ball fired across the stage, in the course of a lecture on projectiles by Professor Robert Spice, of Brooklyn.

The distance measured on the platform was only thirty-three feet, the ordinary distance used in determining this question being about 200 feet. The co-operation of Lieutenant E. L. Merriam, of the Brooklyn 13th regiment, had been secured for the experiment. There was provided a mahogany base, 12 inches by 15 inches, on which were placed two levers which carried bent wires to make marks on a piece of smoked glass underneath the points. One of these wires was connected with a pendulum attached to an Atwood machine, vibrating seconds. By means of electric currents the lever connected with the pendulum came down on the glass precisely at the beginning of each second, making a series of lines separated by spaces somewhat similar to the old Morse alphabet. Consequently the distance from the beginning of one line to the beginning of the next represented a second of time.

The second lever, exactly opposite, had a spring attached to one end, which kept the point off the glass. It also had two electro-magnets, one at each end, which had electric currents passed through of different strength—the weaker current tending to pull the lever down on the glass; the stronger current tending to keep it elevated. In addition to this, the current from the stronger magnet passed through a loose wire resting on two globules of mercury, and immediately in front of this wire was to rest the muzzle of the rifle. The weaker current passed through a precisely similar loose wire, also on two globules of mercury, which wire was placed thirty-three feet distant from the first wire. Lieutenant Merriam's part was to shoot away the wires on the mercury. He used a regular Creedmoor rifle, 45 caliber, 34 inch barrel, loaded with 45 grains of powder (a light charge) and a 450 grain ball. The pendulum was set in motion. On its striking the fifth second the plate of smoked glass was drawn along by the descent of a weight on the top of a column of sand which ran out of a tube. On the sixth second, Lieutenant Merriam pulled the trigger and both wires vanished. On the first wire being broken the point of the corresponding lever descended on the glass, but immediately arose again by the action of a spring, when the bullet broke the second wire. The consequence of this was that the point connected with this lever scraped a very short line on the smoked glass; while the other point, being kept down during the swing of the pendulum, scraped a longer space.

Then the glass was withdrawn and placed in the stereopticon, projecting a magnified image of the lines on the screen. The relative lengths of these lines were ascertained, thus obviating any source of error in measuring the minute lines on the smoked glass. This method of measuring the lengths was claimed to be original by the professor.

The longer line was found to have the length of 110 inches; the shorter 5 inches; making the duration of the flight of the ball 5-110 or 1-22 of a second. Hence its rate of motion was $33 \times 22 = 726$ feet a second.

Corn Malt.

In consequence of the great scarcity of good malting barleys, fresh attention is sure to be directed to the manufacture of maize malt, and we see no reason why a really good brewing material should not be obtained from this grain. One of the principal practical difficulties in the way of malting maize is due to the fact that its husk is so thin, and therefore the grain is very liable to be damaged on the floor. The application of the pneumatic system would probably surmount this difficulty, and we should be glad to hear of some attempts to malt maize in a malting built on the new system. The husk of maize contains a peculiar yellow oily body which is liable to impart an unpleasant flavor to beer, but this may be counteracted to a great extent by repeatedly changing the steep liquor. Maize costs now about 30s. per quarter, which price compares favorably with that of good barley, and only a few practical difficulties require to be surmounted to produce a good malt from this grain; we therefore anticipate it will come more and more in use for this purpose.—*Brewer's Guardian.*

Long Distance Walking.

The six days' walking match which ended in this city Dec. 27 was remarkable, not only for the long distance covered by the winner, but for the number of competitors who covered or exceeded 500 miles. The winner, Hart, made 540 miles; the other distances were 534, 531, 527, 520, 520, 502, 500 miles; eight other competitors equaled or exceeded 450 miles.

Geology of the Rocky Mountains.

Since his return to Edinburgh, Prof. A. Geikie has given to his classes in the university of that city an account of his last summer's observations and studies in connection with Rocky Mountain geology.

He had three objects in the expedition: (1.) To study the effects of atmospheric agencies and of erosion generally upon the surface of the land; and there was no region where those lessons could be learned with more powerful impressiveness than in those great plateaus and table lands. (2.) To study the relation which the structure of the rocks underneath bore to the form of the surface. In this country and in Europe generally one was continually brought face to face with evidence of dislocations, protrusion of igneous rocks, faults, and so on, which greatly complicated the geological structure, and made it sometimes by no means easy to tell how far the present irregularities of the surface were due to unequal waste of surface, and how far to the direct effects of underground causes. The western regions of America, which retained to this day for thousands of square miles the horizontality which they had originally, presented wonderful facilities for the discussion of this subject. (3.) To watch with his own eyes some of the last phases of volcanic action. He had been familiar with this as displayed in Italy and in the Lipari Isles; but he was anxious to see some of those marvelous evidences of the gradual wearing and decay of a vast volcanic area which were so well seen in the famous region of the Yellowstone.

CHARACTERISTICS OF THE ROCKY MOUNTAINS.

The professor went on to give a brief account of his journey, mentioning that in crossing the prairies toward the Rocky Mountains, he noted, in a few sections that occurred, soft, gray clays and marls, evidently cretaceous, and sometimes tertiary rocks. Getting down at some of the stations, and looking at the ant hills and burrows of the prairie dog, he found that the surface of the prairie was veneered with a thin coating of pinkish, fine grained sand, sometimes approaching to gravel, its color being due to the presence of a great many small pieces of fresh feldspar. It was clear that this mineral, as well as the quartz and fragments of topaz which he saw, did not belong to the strata in which they lay. In going west, the grains of sand began to get coarser, and assume the form of distinct pebbles, till, when he reached the mountains, these became huge blocks and bowlders, evidently derived from the hills in their neighborhood. After submitting that the phrase "Rocky Mountains" was a very unfortunate one, as applied to the great number of independent ridges comparable to waves that covered this part of America, the professor said that he halted for a little while on the flanks of the first great mountain ranges—those that formed the colossal bulwarks of Colorado. As seen from the prairies they form a very picturesque line of peaks. They had been pushed as a great wedge through the rocks forming the prairies, and had carried those rocks up with them. Crystalline masses formed the central core and crest of the range, and this feature was combined with some very interesting facts connected with the surface erosion of the district. He found then where all the pink feldspar and gravel had come from; it had been borne down from this region, where great masses of pink granite, gray gneiss, and other crystalline rocks formed the core of the mountains. He found that the mountains themselves had been covered with glaciers, which had gone out into the plains and shed their huge horseshoe-shaped moraines where now everything was parched and barren. Having crossed the watershed of the Rocky Mountains, he struck westward into the Uintah, one of the few ranges in that region that had an east and west direction. The central portion of this range consisted, not of crystalline rocks wedged through the older rocks, but of carboniferous rocks that had been upraised as a great flat dome, and had been above water for a very long time. This carboniferous center was particularly interesting from the fact of its presenting the strata perfectly horizontal. They could be seen, terrace after terrace, for miles, and it could be noted whether or not they had been cut through, by faults, to what extent they had been twisted, and to what extent eroded by atmospheric influences. Getting on the tops of these great mountains, he could see that the strata were almost entirely horizontal for miles, and that the valleys had been trenched out of them, not by means of faults at all, but actually by erosion of the surface. He found also that the numerous lakes were true remains of erosion, that they had not been formed by any subterranean movements, but actually gouged out by the ice that once covered those mountains. Striking into one of the valleys, he found beautiful horseshoe moraines. These had gone across the valley and formed a succession of lakes; while the beavers had made a great many more lakes in places not reached by the moraines. In most of these valleys there were hundreds of acres of bog land, entirely due to the damming of the waters by the beavers. The plains in the neighborhood of the Uintah Mountains were called "bad lands," because they were crumbling down under the action of the weather, and nothing would grow upon them. A skeleton found in a hill of that district was brought to Professor Marsh, and turned out to be the bones of an extinct and undescribed reptile.

VOLCANIC REMAINS IN THE YELLOWSTONE COUNTRY.

From the Uintah Mountains Professor Geikie found his way north into the Yellowstone country, and examined the fading traces of volcanic action. The volcanoes seemed in that region to have confined themselves very much to the valleys. The heights on either hand consisted of crystalline

rocks; the bottom of the valley had been literally deluged with sheets of lava. These were examined with considerable care. In the course of the examination, huge mounds of gravel and stones were met with, which, at the first glance, were evidently moraines. The first was marked by a huge block of rock, an erratic of coarse granite, different from the rocks round about. Such blocks he found to increase in number as he went up the valley; and on entering the second cañon, or gorge, he found the sides exquisitely glaciated. It was clear, therefore, that not only was this second cañon old; it was older than the glacial period; it supplied a channel for the glacier that ground its way out from those mountains. Endeavoring to estimate the minimum thickness of the ice, he traced striæ up to 1,000 feet, and they evidently went higher than that. But in going further up the valley, he found that the erratic blocks of granite and gneiss dropped by the glacier as it melted went far above the 1,000 foot limit; he got them on the shoulder of one of the great hills overlooking the valley 1,600 or 1,700 feet above the bottom of the valley; the ice, therefore, must have been 1,600 or 1,700 feet thick. It thus appeared that not only did those mountains possess glaciers, but some of these were of such thickness as to deserve the name of ice sheets, covering the whole surrounding region. As to the volcanic phenomena of the district, he saw evidence of a long series of eruptions, one after another, separated by prolonged intervals, during which the river was at work cutting out the older lavas, the newer lavas filling up the hollows eroded by the river. In the grand cañon of the Yellowstone he saw the most marvelous piece of mineral color anywhere to be seen in the world. It was cut out of tuffs of lavas, showing sulphur yellow, green, vermilion, crimson, and orange tints, so marvelous that it was impossible to transfer them to paper.

THE GEYSERS.

Leaving the Yellowstone Valley, he struck southwestward into the famous geyser regions, where a number of geysers had been made known of late years more wonderful than those of Iceland. He tried hard here to get a pool to wash in, but could find nothing below 212°, and the only chance of getting a bath was to get into some hole where the water had had time to cool after flowing out of the hot crater. The whole ground was honeycombed with holes, every one of which was filled with gurgling, boiling water. Some went off with wonderful regularity, others were more capricious; and the chief geyser, which threw up an enormous body of water and steam, was very uncertain in its movements. In one part of the district he came upon a marvelous mud spring, the center of it boiling like a great porridge pot full of white and very pasty porridge. Steam rose through this, and, after forming great bubbles, burst, the mud thrown out forming a sort of rim round the crater. After describing a meeting with Indians on their way to a great council, the professor said his road after that lay across what he supposed was one of the most wonderful lava fields in the world—hundreds and thousands of square miles of country—a sort of rough plain—having been absolutely deluged with lava. How this lava was poured out he at present could hardly tell; it seemed to have risen through long fissures, and spread out so as to fill a vast area. Here and there along the margin of it were distinct volcanic mounds, apparently formed during later stages of its volcanic history.

THE VICINITY OF SALT LAKE.

Coming at length to the Salt Lake territory, one of the first geological features that struck him was the evidence for the former vast expansion of the Salt Lake. He found traces of a terrace well marked along the sides of the mountains, about 1,000 feet above the present level, and so succeeded in discovering what was the relation between the extended lake, which must have been a great many times larger than the present one, and 1,000 feet deeper, and the glaciers which at one time covered the Wahsatch and the Yellowstone Mountains. Striking into some of the cañons descending from the Wahsatch into the Salt Lake basin, he found evidence of wonderful glaciation. The rocks were smoothed and polished and striated by the glaciers that had come down from the heights, and these glaciers had carried with them great quantities of moraine matter. Huge mounds of rubbish blocked up the valleys here and there, and these mounds came down to the level of the highest terrace. That was to say, that, when the Salt Lake extended far beyond its present area, and was over 1,000 feet deeper than now, the glaciers from the Wahsatch Mountains came down to its edge and shed their bergs over its waters. On his return journey the professor resumed the examination of the prairies. Coming out of the Colorado Mountains, he noted, in connection with the gravel formerly observed, great quantities of a peculiar gray clay. This clay was interstratified with the gravel, and here and there contained a small lacustrine, or terrestrial shell. It was, therefore, a fresh water deposit, a deposit swept by the waters coming down from the mountains over the prairie; and marked an interval in the period during which the gravel and sand were being thrown down. He traced the gravel mounds over an extensive tract, and he found the gravel had been deposited irregularly, just as would have been the case from the action of water escaping from the melting ends of the ice. A great current would traverse the plain in one direction, then the ice mass would send water in another, so that the whole prairie must have been flooded with water derived from the melting ends of the vast sheets of ice. It was those excessive floods that brought down the gravel and sand; and during that time there were intervals when nothing but the finest mud was coming down, just as was seen in the valley of the Rhine and Danube.

The Geodetic Survey of the Great Lakes.

A great deal of curiosity having been excited in the eastern part of Illinois with regard to certain pyramidal structures in that region, the meaning of which the average citizen could not make out, Professor J. O. Barker, of the State University, rises to explain. They are observatories built by the United States lake survey, and are a part of a chain of such stations extending from near Chicago to the Ohio and Mississippi Railroad near Olney, Ill. For many years past the War Department has been engaged in making a very accurate survey of the shores of the great lakes. The method is that known among engineers as a trigonometrical or triangulation survey. This consists in measuring very carefully a line five or six miles long, called a base. From the extremities of this line angles are measured to distant signals erected for the purpose. Then, having measured one side and the angles by trigonometry, they calculate the distance from the base to the distant signals and also the distance between the signals. From these latter stations they measure angles to still other stations, and so continue until they have spanned the whole section to be surveyed with a network of triangles, whose sides are ten, twenty, thirty, and sometimes as much as a hundred miles long. When a map is desired, numerous smaller triangles are measured inside of the larger ones, thus determining the position of a great many points very accurately. Near the close of the work another base line is measured to test the accuracy of the intervening operations. These bases are measured with apparatus constructed expressly for the purpose, and the degree of accuracy is most wonderful, the error often being no more than the sixteenth of an inch in a mile. This system of surveying is the most accurate known. In one instance the lake survey triangulated about three hundred miles with no greater error than four inches, and this is not an exceptional case.

In the beginning the object was a survey of the great lakes for the aid of navigation, and for this purpose the system of triangles was carried around the shores. In the prosecution of this work a line of triangles was extended from the north of Lake Superior to a few miles south of Chicago.

The lake survey having about completed the work for which it was organized, it was suggested by scientific men that the chain of triangles already referred to be extended south from Chicago for the purpose of measuring an arc of the earth's meridian. Astronomers and engineers determined the size and form of the earth by measuring a portion of the circumference. In scientific circles there has always been a great interest connected with the size and figure of the earth, and just now there is increased interest on account of the transit of Venus, which was so much written about in the papers a few years ago. Astronomers use the radius of the earth as the foot rule with which they measure the distance and sizes of the heavenly bodies.

Then, to get back where we started from, the work which the lake survey is now doing in our midst is the measurement of an arc of a meridian from which can be determined the radius of the earth. The structures which have caused so much inquiry among our farmer friends are the observatories built by the lake survey for the purpose of elevating their instruments and signals so as to get a better view of the distant targets.

Nearly all civilized countries have been engaged more or less in the determination of the figure of the earth. The methods and means used by the American coast and land survey are equal, if not superior, to any ever before used, and hence the scientific world waits with great interest for the results of our geodetic surveys. The United States has an enviable international reputation for the liberality and the skill with which our surveys have been conducted. Every American should feel proud of the distinction his country has thus attained.

People frequently ask of what practical benefit is all this. We reply that the principal object of the survey is as above indicated, that is, the advancement of pure science and to add to the sum total of human knowledge. It has nothing to do, as some seem to think, with the land survey. However, it could be utilized in this respect if Illinois should choose to make a trigonometrical survey of this State as has been done in several Eastern States. To some it may seem that the engineers are not very industrious, but such is not the case, since they can only do first-class work under the most favorable circumstances. It was the hope and intention to finish the field work last fall. The computations will take perhaps a year longer.

New Kinds of Plated Sheet Iron.

In Iserlohn, Westphalia, thin sheet iron is plated with alloys of nickel or cobalt and manganese. A half of one per cent of manganese makes cobalt and nickel very malleable, fluid when melted, and ductile. The plates, which are already in the market, are beautifully white and brilliant.—*Metallarbeiter.*

New Jersey's Silk Industry.

Statistics gathered for the forthcoming annual report of the New Jersey Labor Bureau include reports from sixty-seven silk mills, mostly in Paterson. The Paterson mills alone employ 10,000 hands, besides from 2,000 to 3,000 employed in their own homes. The annual production of these mills reaches the total of $14,000,000.

MISCELLANEOUS INVENTIONS.

An improved instrument for mending harness and other articles, patented by Mr. Charles P. Adams, of Stockbridge, Mass., consists in a handle made of such a shape and size as to serve as a receptacle for various tools. It is made with a large central cavity, which is surrounded with a number of smaller cavities of suitable shape and size to serve as receptacles for a knife blade, a needle, a hook for removing stones from horses' feet, and other suitable tools.

Mr. Walter F. Jenkins, of Fithian, Ill., has invented an improved clothes pounder having a hollow stem made with an enlarged upper part and provided with a set of valves and partitions, so that the obstruction of one valve will not interfere with the working of the other.

Mr. Emery M. Hamilton, of New York city, has patented a T-square for use in making perspective drawings, whereby the mechanical difficulties connected with such work may be readily overcome. Heretofore in making such drawings, to avoid the tedious process of working by diagonals or by elaborate scales, whereby only an accurate perspective could be obtained, the draughtsman has usually made the vanishing point too close, so as to bring it within reach, or has selected a point of view with reference to the angle that will effect the same object, the result in either case being to cramp or distort the drawing. This invention consists in a T-square, fitted with a swinging blade, adapted for giving perspective lines vanishing either to the right or left at any distance. The blade is moved by an adjustable slide piece, that is attached upon the drawing board, so that by it a true and accurate perspective drawing may be made with facility.

Mr. Otto Ernst, of South Amboy, N. J., has patented an improved building for cremation purposes. The object of the invention is to associate the process of cremation with the usual practices at funerals; and the invention relates to the peculiar arrangement and construction of cremation furnaces, in connection with a building or temple.

All horses, when in motion, necessarily move the head independently of the body, which causes a jerk or pull on the driver's or rider's hand, and, the mouth of the horse being very sensitive, the effect is unpleasant to both driver (or rider) and the horse. This result is due to the want of elasticity of the reins, or what are in some localities denominated "lines." To remove the difficulty, Mr. Benjamin A. Davis, of Petersburg, Va., has patented lines provided with an attachment which renders them elastic within certain limits, or up to a certain degree of tension, but has no effect when such limit or degree is exceeded.

Messrs. William M. Smeaton and John Smeaton, of Newcastle Street, Strand, County of Middlesex, England, have patented an improved water closet valve mechanism adapted to be brought into operation by a pull or handle for the purpose of regulating the amount and preventing the waste of the water supplied to the bowl of a water-closet, to flush and cleanse it during or subsequent to use.

Messrs. Mortimer H. Bachman and Sebastian S. Peckinpaugh, of Stanton, Mich., have recently patented an improved process of photo-negative engraving, which consists in placing a mask over, but not in contact with, the negative previously developed by the usual process of photography, for the purpose of preserving intact any portion of the object upon the negative, while the remainder not wanted is obliterated by exposure to the light, and the negative subsequently finished in the usual manner and engraved by means of a sharp steel instrument, which cuts through the varnish and exposes the glass, so that whatever design is engraved will be printed along with the photograph.

An improvement in buckles has been patented by Mr. George G. Bugbee, of Gonzales, Texas. The invention relates to buckles for harness or other purposes, adapted for connection to a strap or billet without sewing; and the invention consists in a buckle having a rigid crossbar, that is formed with a loop or crank-shaped tongue, over which the billet or strap is placed to secure the buckle, and on which the swinging tongue of the buckle is secured, this construction rendering the buckle more compact and of better appearance than double tongue buckles as heretofore made, and giving a wider range of use for the buckle.

Mr. Henry Gottlieb, of New York city, has patented an improved billiard cue cutter, which consists of a cylindrical box, four or five inches long, or thereabout, bored throughout its length for the admission of the end of the cue. The box is divided longitudinally into halves that are hinged together at the lower end by an annular hinge, and are prevented from separating too far at the top by a slotted circular plate that is fastened on the top of one half and engages with staples on the other, and under this plate is secured a blade that projects horizontally part-way over the bore.

An improved Wagon Cover, patented by Mr. Thomas Danahey, of Council Bluffs, Iowa, consists in making a bow of two straight springs of equal length, and connecting them by a top hinge, while on the other side, opposite to the wings of hinge, are arranged two stops that abut together and limit the inward movement of the hinge ends of the spring toward each other.

Mr. Edward Clark, of Jersey City, N. J., has patented an improved composition for fire kindlers, composed of resin, lard, washing soda, flour paste, and sawdust.

An improved railway rail has been patented by Mr. Silas Nicholls, of Westminster, England. It consists in a rail, constructed of parallel lengths or half rails, of channeled iron or steel of ⊐ shaped section, bolted or riveted together, with their channeled sides outward, and with cast iron spacing blocks between.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) E. H. B. asks: How much bichromate of potash should be added to a given quantity of Indian ink for drawing purposes? A. Reduce a small quantity of the bichromate to powder and dissolve in a limited quantity of boiling water. There should be an excess of the salt beyond what is taken up by the water. When the solution has cooled, pour it off from the residue, and bottle. When required for use, dilute the solution with about one third its volume of water, and it is ready for use.

(2) A. R. asks: How can I prepare porous silica for polishing metals? A. An article similar to porous silica may be prepared by treating a strong solution of water glass (silicate of soda) with a small quantity of strong oil of vitriol. If the solution has been sufficiently strong, after standing a few hours in a warm place it will completely gelatinize. Wash this well with cold water, decant or filter off the washwater from the gelatinous silica (hydrated silicic acid), place the latter in a suitable vessel, and dry over a good fire.

(3) C. D. W. writes: 1. I am constructing an electric machine, from directions given in SUPPLEMENT 161. In making the patterns, divided the cross piece on top, in the middle, to save making two patterns. Is there any objection to that? A. No. 2. Must the electro-magnets be finished? I pickled mine, and rubbed them up pretty well with an old file. A. The contact surfaces of the two parts should be well fitted to each other. Otherwise no finish is required. 3. On making the armature, I have got seven layers of wire, where there are but five in the engraving. Is this a fault? A. You can determine by experiment. Put a loop at the end of the fifth, sixth, and seventh layers, and vary the length of wire used until you get the best effect. 4. In making the commutator I could not get vulcanite, so took a piece of apple wood and gave it several coats of shellac varnish. Will that do? A. Yes.

(4) W. W. N. writes: A dispute arose between two parties, they agreeing to leave the decision to your paper. A argues that the Pacific Ocean is higher than the Atlantic. Proof being the currents running from the Pacific to the Atlantic; and that if a canal be built through the Isthmus of Panama an immense current from Pacific to Atlantic will be the result, which will have to be counteracted by immense locks. B argues that the theory, "water seeks its own level," holds good for the oceans, and no such current will result. A. There is no difference at mean tide. The tides on the Pacific side are about three feet; on the Atlantic side they are five or six times as great.

(5) J. M. S. asks for a rule to figure the resistance caused by surface friction to a boat passing through the water. I don't mean displacement, but the friction of the water against the sides and bottom of the boat. A. There are no rules determined, suitable for practical application. The amount of resistance in each particular case depends upon: 1. The character and smoothness of the surface. 2. The length of body over which the water glides. 3. The velocity of the water over the surface of the body.

(6) C. C. writes: Having often heard the word "spiling" used by shipwrights in the phrase "taking a spiling," meaning the taking of the shape of any irregular surface as measured from a straight line by ordinates, will you please inform me if the word has any sanction of authority, as I am unable to find it in Webster? A. In "Knight's Mechanical Dictionary" for *Spiling;* the edge curve of a plank or strake. *Spilings;* dimensions taken from a straight edge or rule, to different points on a curve.

(7) E. C. B. asks: Has an alphabet of sound figures been established, so that speech may be readily read off from the phonograph or phonoscope, with or without a magnifying glass? A. No, the impressions vary too much with different voices.

(8) K. asks for a preparation to touch up black baked japanned goods which have been marred. The varnish should be applied with a brush. What black preparation can be applied to iron with a brush, which will have the appearance of black japan and will not wear off? A. Finely ground bone black mixed with a good quality of furniture varnish answers very well for these purposes.

(9) J. S. inquires how to make rouge for polishing purposes. A. Take crystals of sulphate of iron (green vitriol or copperas), have them as clean as possible; and put them into crucibles or cast iron pots and expose them to heat, without suffering the smallest particles of dust to get in, which would have a tendency to scratch the articles to be polished. Those portions which are least calcined, and are of scarlet color, are fit to make rouge for polishing gold or silver; while those which are more calcined, or have become red, purple, or bluish purple, form crocus fit for polishing brass or steel.

COMMUNICATIONS RECEIVED.

On the Figure 9. By G. C.

A Suggestion to Inventors. By L. N. D.

On a New System of Weights and Measures. By D. B.

On the Telephone Under Water. By S. B.

On Boiler Explosions. By S. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 16, 1879.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

TRADE MARKS.

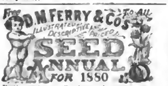
DESIGNS.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.



Will be mailed free to all applicants, and to customers without ordering it. It contains four colored plates, 600 engravings, about 200 pages, and full descriptions, prices and directions for planting 1500 varieties of Vegetable and Flower Seeds, Plants, Roses, etc. Invaluable to all. Send for it. Address,
D. M. FERRY & CO., Detroit, Mich.

PIANOS-ORGANS
CHEAPEST HOUSE IN AMERICA. 1st-class instruments, all new, for cash or installments, warranted 6 years. Illustrated catalogues free. Agents wanted. T. LEEDS WATERS, Agt., 28 West 14th st., New York.

1,200 per cent. profit manufacturing our patent Anti-Scalding Clothes Stick; sells at every home; license granted for 3 years covering one county for $5.00; any township for $1.00, including sample, carriage paid. Address BAUDER & CO., Birmingham, Erie Co., Ohio.

Dead Stroke Power Hammers
are superior to all others for forging and die work. Over 300 now in use. Manufactured by
PHILIP S. JUSTICE,
14 North 5th Street, Philadelphia, Pa.

DYSPEPSIA. BY DR. C. F. KUNZE. Symptoms. Appetite Diminished. Stomach Digestion much slower than Normal. Constipation. Symptoms in Children. Chronic Cases. Dyspepsia is caused by too much Food; by Indigestible Food; by General Derangement; by Altered Conditions of Innervation. Treatment. Nourishment should be Easily Digestible, taken Little at a Time; and Digested before more is taken. Necessity of Few and Plain Dishes. Treatment when Stomach is Overloaded. Aiding Gastric Juice. Treatment in Febrile Diseases. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 129. Price 10 cents. To be had at this office and of all newsdealers.

Burke's Texas Almanac for 1880, with map, contains 300 pp. information about Texas and her resources, price 50c. J. BURKE, JR., publisher, Houston, Texas.

MANUFACTURERS OF MACHINES FOR making gas from Petroleum by heat are requested to send descriptive circulars, testimonials, etc., to
J. ADDISON,
Care Washburn & Moen Co.,
31 Cliff Street, New York.

Electro-Bronzing on Iron. New Patent. Indestructible and unchanging by atmospheric action. Use of these patent rights can be obtained on favorable terms. PHILA. SMELTING CO., Phila., Pa. Brass, Tool, Steel, and File Works. PHILA., Oct. 4, 1879. To Philadelphia Smelting Co., GENTS: After a trial of eighteen months of your Marbleized metals ... in our Rolling Mill where great pressure is required, we take pleasure in recommending it as being superior to any we have heretofore used. We also refer to ... Eagle Iron Works, Hoff, Fontaine & Abbott, Phila.

For Blasting. Safe, Reliable, Economical. MINERS' SUPPLY CO., St. Clair, Schuylkill Co., Pa.

FOR SALE.
One new Moyer Scroll Saw at half cost to build. A Boiler, flush front pattern, and a lot of miscellaneous patterns, the collection of forty years, at a bargain. Address immediately, Wood, Smith & Co., Fort Plain, N.Y.

PATENTS WANTED.—All patentees address, with stamp for particulars, Southern Pat. Sale Agency, Mobile, Ala.

TELEPHONE Works 1 mile. Price $3.50. Pat'd. Circulars free. Holcomb & Co., Mallet Creek, Ohio.

WOOD WORKING MACHINERY
IRON WORKING TOOLS
SPECIAL TOOLS
MANUFACTURED BY
H. B. SMITH MACHINE CO.
SMITHVILLE, BUR. CO., N.J.
CIRCULARS FREE.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 233 Broadway, N.Y., who control the patent for Green's American Driven Well.

Pond's Tools,
Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

Baker Rotary Pressure Blower,
(FORCED BLAST.)

Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA.

NEW YORK BELTING AND PACKING COMP'Y.
The Oldest and Largest Manufacturers of the Original
SOLID VULCANITE

EMERY WHEELS.
All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.
Address NEW YORK BELTING AND PACKING CO.,
Emery Wheel. JOHN H. CHEEVER, Treas. NEW YORK.

BI-SULPHIDE OF
CARBON.
Manufactured by E. R. TAYLOR, Cleveland, Ohio.

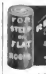
JOHN R. WHITLEY & CO.
European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E.C. Paris, 8 Place Vendome. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

Paris, . . 1878
Australia, 1877
Phila., . . 1876
Santiago, 1875
Vienna, . 1873

J. A. FAY & CO'S
WOOD WORKING MACHINERY
was awarded at the Paris Exposition over all competitors THE GOLD MEDAL OF HONOR. Also highest award at Phila., Santiago, Australia, and Vienna. It is **Original in Design, Simple in Construction, Perfect in Workmanship, Saves labor, Economizes lumber, and increases products of the highest standard of Excellence.** Railroad, Furniture, and Agricultural Implement Shops, Planing Mills, etc., equipped at short notice, and the lowest cash prices. Send for circulars.
J. A. FAY & CO., Cincinnati, Ohio, U. S. A.

FIRE BRICK TILE AND CLAY RETORTS ALL SHAPES. BORGNER & O'BRIEN, 23D ST. ABOVE RACE, PHILADELPHIA.

Cigar Box Lumber,
MANUFACTURED by our NEW PATENT PROCESS.
The Best in the World.
SPANISH CEDAR,
MAHOGANY,
POPLAR.
Also thin lumber of all other kinds, ⅛ to ½ in., at corresponding prices. All qualities. Equal in all respects to any made, and at prices much under any to be obtained outside of our establishment. Send for price list.
GEO. W. READ & CO.,
186 to 200 Lewis Street, N. Y.



ROOFING
SEND FOR SAMPLE & CIRCULAR
W. H. STEWART
74 COURTLAND ST. NEW-YORK.

VALUABLE PATENT CHEAP FOR CASH. Revolving Sulkey Harrow. Patented 1878. All territory with exception of Kansas and Missouri. Single States or all. Fortune for right parties. Send for circulars. G. B. GABLE, Corpus Christi, Texas.

Grain Speculation!
Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., Chicago, Ill., for Circulars.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators,
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

JAMES ECCLES,
General Machinist, Inventor, and Maker of the
Patent Quadruple Screw Power Press
For the use of Printers, Hosiery Manufacturers, and all others who desire great and uniform pressure.
2423 Lombard St., Philadelphia, Pa.
ESTABLISHED 1850.

$10,000. SAFETY LAMP.
Mailed Free for 35 Cts. Four for $1. $10,000 will be paid to any person who can explode a Lamp fitted with our UNITED SAFETY ATTACHMENT. May use any lamp or burner. Prevents dripping and soiling. Sent free by mail for example, with size of collar and depth of your lamp.
AGENTS WANTED.
S. S. Newton's Safety Lamp Co., 13 West Broadway, New York.
Factory and Office, Binghamton, N. Y.

BRADFORD MILL CO.
Successors to Jas. Bradford & Co., Manufacturers of
French Buhr Millstones,
Portable Corn & Flour Mills,
Smut Machines, etc.
Also, dealers in Bolting Cloths and General Mill Furnishings.
Office & Factory, 158 W. 2d St.
CINCINNATI, O.
J. R. Stewart, Pres. W. R. Dunlap, Sec.
☞ PRICE LISTS SENT ON APPLICATION.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.

For breaking hard and brittle substances to any size. Endorsed by the leading Mining, Manufacturing, and Railroad corporations in the United States and Foreign Countries. First Premiums wherever exhibited, and hundreds of testimonials of the highest character. Indispensable for making best Macadam Roads, Ballasting of Railroads, Crushing the hardest Ores, Stone for Concrete, etc., etc. Prices greatly reduced.
The CHALLENGE was awarded the MEDAL OF SUPERIORITY by the Judges of the American Institute Fair, New York City, December, 1879, where it was exhibited in competition with our old form of Crusher.
Address BLAKE CRUSHER CO., New Haven, Conn.

CEMENTS.—FORTY VALUABLE RECEIPTS for a great variety of cements, applicable to all of the purposes of the Household and Shop, including Rubber Cement, Waterproof Cements, Acid-proof Cements, Fireproof Cements, Aquarium Cements, Hydraulic and Battery Cements. Cement for paper boxes, for metals, for china and glassware, for leather, rubber, etc., for cementing leather and rubber to metals, glass, etc. Cements for wood, stone, iron, etc. Recipe for Colored Sealing Wax, for Postage Stamp Mucilage, for Crockery Ware, Cement to resist Petroleum. Japanese Cement. Cologne Beton Cement. Recipe for Fireproof Paper and Ink. Contained in SCIENTIFIC AMERICAN SUPPLEMENT 158. Price 10 cents. To be had at this office and of all newsdealers.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. 234 W. 29 ST. NEW YORK CITY.

"The 1876 Injector."
Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.

Shafts, Pulleys, Hangers, Etc.
Full assortment in store for immediate delivery.
WM. SELLERS & CO.,
79 Liberty Street, New York.

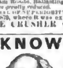
Has More Good Points,
Does More and Better Work,
Takes Less Power,
Than any Hammer in the World.
BRADLEY & COMPANY,
SYRACUSE, N.Y.

MACHINISTS' TOOLS.
Iron Planing Machines
A SPECIALTY.
C. WHITCOMB & CO., Worcester, Mass.

$77 a Month and expenses guaranteed to Agents. Outfit free. SHAW & CO., AUGUSTA, MAINE.

ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 1. The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

KNOW THYSELF.



THE untold miseries that result from indiscretion in early life may be alleviated and cured. Those who doubt this assertion should purchase the new medical work published by the PEABODY MEDICAL INSTITUTE, Boston, entitled THE SCIENCE OF LIFE; or, SELF-PRESERVATION. Exhausted vitality, nervous and physical debility, or vitality impaired by the errors of youth, or too close application to business, may be restored and manhood regained.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jeweled medal by the National Medical Association. It contains beautiful and very expensive engravings. Three hundred pages, more than 50 valuable prescriptions for all forms of prevailing disease, the result of many years of extensive and successful practice, either one of which is worth ten times the price of the book. Bound in French cloth; price only $1, sent by mail, postpaid.

The London *Lancet* says: "No person should be without this valuable book. The author is a noble benefactor."

An illustrated sample sent to all on receipt of 6 cents for postage.

The author refers, by permission, to JOS. S. FISHER, president; W. I. P. INGRAHAM, vice-president; W. PAINE, M.D.; C. S. GAUNTT, M.D.; H. J. DOUCET, M.D.; R. H. KLINE, M.D.; J. R. HOLCOMB, M.D.; N. R. LYNCH, M.D., and M. R. O'CONNELL, M.D., faculty of the Philadelphia University of Medicine and Surgery; also the faculty of the American University of Philadelphia; also Hon. P. A. BISSELL, M.D., president of the National Medical Association.

Address Dr. W. H. PARKER, No. 4 Bulfinch Street, Boston, Mass. The author may be consulted on all diseases requiring skill and experience.

HEAL THYSELF.

PATENT
COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburg, Pa.
190 S. Canal Street, Chicago, Ill.
☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass. Geo. Place Machinery Agency, 121 Chambers St., N. Y.

Small Tools of all kinds; GEAR WHEELS, parts of MODELS, and materials of all kinds. Catalogues free. GOODNOW & WIGHTMAN, 176 Wash'n St., Boston, Mass.

Forster's Rock & Ore Breaker and Combined Crusher and Pulverizer.
The simplest machine ever devised for the purpose.
Parties who have used it constantly for six years testify that it will do double the work of any other Crusher, with one-third the Power, and one-half the expense for keeping in repair. The smaller sizes can be run with Horse Power.
Address TOTTEN & CO., Pittsburgh, Pa.

STEAM PUMPS.
HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.
THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.
STEAM PUMPS—Duplex and Single Cylinder.

Prices below those of any other steam pump in the market.
WATER METERS. OIL METERS.

RAPID ADDITION!
Wonderful Invention!
ART of Adding Figures from Left to Right; or from Middle either way; or six columns at one time. Done as Quick as Thought! Sent to any address on receipt of Price. 50 Cents in postage stamps.
W. F. MERRIMAN, Batavia, N. Y.

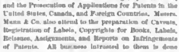
PRINCIPLES OF HORSE SHOEING.—By Geo. Fleming, V.S. A paper describing the proper method of shoeing horses so that the animal's feet may be kept always healthy and sound. How much the walls of the hoof should be reduced, and how the operation should be performed; the kind of shoes that should be selected; how they should be fitted; the number and size of nails that should be used, and how the face of the hoof should be treated. Followed by a description of a modified form of the "Charlier" method as successfully followed by the author for many years. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 203. Price 10 cents. To be had at this office and from all newsdealers.

FOUR SIDED MOULDER, WITH OUTside bearing. We manufacture 5 sizes of these moulders.

Also Endless Bed Planers, Mortisers and Borers, Tenoning Machines, Sash Dovetailers, Blind Rabbeting Machines. Also a large variety of other wood working machines.
Address
LEVI HOUSTON, Montgomery, Pa.

FOR SALE.—ONE SELF-ACTING LATHE, WITH compound slide rest and geared face plate. Bed, 18½ ft.; swing, 7 ft. 4 in.; weight, 6½ tons.
ONE CHUCKING LATHE, with geared face plate, 8 ft. 10 in.; heavy compound slide rest; weight, with counter shaft, 4 tons.
ONE SELF-ACTING LATHE, with compound slide rest. Bed, 28 ft. 6 in.; swing, 35 in.; weight, with counter shaft, 4,000 lb.
For inspection or detailed description, apply
MIDVALE STEEL WORKS, Nicetown, Phila., Pa.

SILVERING GLASS.—THE LATEST AND Best Method of Silvering Mirrors and other articles of Glass by Chapman's, Smith's, Petitjean's, Draper's, and Liebig's Processes. SUPPLEMENT 105. Price 10 cents.



CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

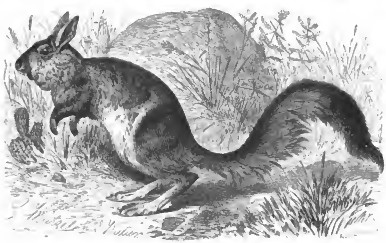
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.
BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

THE SPRING HAAS.

One of the most familiar of leaping rodents is the spring haas, of Cape Gerboa, sometimes called, from its hare-like aspect, the Cape leaping hare. It is a native of Southern Africa, and is found in considerable numbers upon the sides of mountains, where it inhabits certain burrows which it tunnels for itself in the ground. It prefers sandy ground for the locality of its habitation, and associates together in great profusion in favorable spots, so that the earth is completely honeycombed with its burrows. Being a nocturnal animal, it is rarely seen by daylight, seldom leaving its stronghold as long as the sun is above the horizon. The natives, who set some value on its flesh, take advantage of this habit, and being sure of finding the spring haas at home during the daytime, take their measures accordingly. Placing a sentinel at the mouth of the burrow, they force the inmate to evacuate the premises by pouring a deluge of water into the hole, and as it rushes into the open air it is seized or struck down by the ready hand of the sentinel.*

Like the kangaroos, the spring haas prefers rough and rocky ground to a smooth soil, and displays such wonderful agility as it leaps from spot to spot, that it can baffle almost any foe by its mere power of jumping. At a single leap this creature will compass a space of twenty or thirty feet, and is able to continue these extraordinary bounds for a great distance. It is rather a mischievous animal, as, like the common hare, it is in the habit of making nocturnal raids upon the corn fields and gardens, and escaping safely to its subterranean burrow before the sunrise.

With the exception of shorter ears and the elongated hinder limbs, the spring haas is not unlike our common hare. The fur is of a dark fawn, or reddish-brown, perceptibly tinged with yellow on the upper parts, and fading into grayish white beneath. In texture it is very similar to that of the hare. The tail is about as long as the body, and is heavily covered with rather stiff hairs, which, at the extremity, are of a deep black hue. Upon the fore legs there are five toes, which are armed with powerful claws, by means of which the animal digs its burrows, while the hinder feet are only furnished with four toes, each of which is tipped with a long and rather sharply pointed claw.



SPRING HAAS.—*Helamys Capensis.*

The Frog Poison of Colombia.

M. André, who was sent to South America on a scientific mission by the French government in 1875, communicates an article to *La Nature* on the subject of a poisonous frog met with in Colombia, and from this we copy the following notes:

This batrachian—called by the Indians of the Choco, "Neaara"—although harmless in appearance, carries one of the most terrible poisons known. It is used for poisoning arrows and serves the Choco Indians as a substitute for the famous *curari* employed by the savages of the Orinoco and Brazil. The three principal tribes which inhabit the immense forests of the Choco are the Cunas, the Noanamas, and the Chocoes.

Great rivers, such as the Atrato and San Juan, water these vast solitudes where the jaguar, the tapir, immense boas, and the caymans make their quarters, disturbed only now and then by the Indians who come to hunt them. For many ages this hunting has been done by means of a weapon called the "sarbacane" or "bodoquera"—a tube about 10 feet long made of the two halves of a palm stalk, which is split, scooped out, and put together again, and then wound with fibers and covered with a black, hard-drying gum. The arrows are made of small bamboo rods, which are very slender and about the length of a knitting needle. They are sharpened at one end, wound around with wild cotton at the other so as to make them just fit the diameter of the tube, and are shot out of the blow-gun with great force by the breath of the hunter. The point of these arrows is dipped in a subtile poison which is nothing else than the venom of the frog just mentioned. To obtain the poison for their weapons the Indians go in search of the little batrachian to the districts of Rio Tatama, an affluent of the San Juan. The agility of the animals renders them difficult of capture, and as this has to be effected by hand, the latter is always covered with large leaves to prevent its coming in contact with the poison. Once taken, the frog is inclosed in a piece of bamboo and carried to the camp, where a long pointed stick is thrust down through its mouth and out through the extremity of its body. A fire having been lighted the spitted animal is turned round over the glowing embers until at length its skin begins to swell, and a yellowish acrid juice exudes, and into this are dipped the arrows to be poisoned. Sometimes the poison is obtained on a larger scale by scraping the juice from the body into an earthen pot by means of a knife, and this is afterwards fastened to the hunter's girdle along side of his quiver and used as wanted. The venom, which is only used before its solidification, keeps for some time, but at length acquires the consistency of curari. The physiological effects of this poison are quite similar to those produced by curari. Introduced into the stomach the substance has no effect, but once introduced into the circulation it causes a momentary paralysis, but one which lasts long enough to kill the animal wounded by a poisoned arrow. A single arrow shot into a roebuck thoroughly disables it in ten minutes, and it takes only double that length of time to kill a full grown jaguar. No antidote is known for the poison, and the Indians are so thoroughly aware of this fact that when one has the misfortune to wound himself with an arrow he lies down quietly to await death without making any efforts to cure himself. The Choco frog belongs to the genus *Phyllobates* erected by Bibron and Dumeril. It is probably only a variety of *P. bicolor Bibr.*, which is an inhabitant of trees in Cuba, while the Choco variety is terrestrial. It would be interesting to make experiments on other species of allied batrachians found in the warmer regions of the globe; for, just as the venom of serpents differs considerably according to the species, so the cutaneous secretion derived from batrachians by artificial means may vary in its composition and in the toxic effects which result from its introduction into the circulation.

CHINESE VASE.

Our engraving represents an example of opaque *cloisonné* enameling on metal for which the Chinese have a world-wide reputation. Some of the finer pieces of the ware are valued at several thousand dollars. One of the most elegant of these vases is shown in our illustration.

This vase measures some five feet in height by three feet in breadth. Its prevailing color is sea green, but other colors, such as blue, yellow, and red, appear upon its surface, and the birds, which are marvels of workmanship, have the color of their plumage copied after nature.

The engraving excellently illustrates the exceeding delicacy of the ornamentation, but it is necessary to understand something of the laborious processes by which this effect was produced in order to appreciate its great value.

Enameling, in its broadest sense, is the act of fixing a vitreous substance on any surface by fusion; usually that surface is a metal. Enamels are either transparent or opaque, and are colored by metallic oxides. The processes by which it is embedded upon or in the metal give the names *cloisonné* and *champlevé*.

There are other processes of enameling, but it is needless to speak of them in this connection. In *cloisonné* enameling the pattern is formed by slender strips of metal being bent into required shape, and fixed to the plate. Into the *cells* (whence the name) thus formed, the workman pours his enamel paste, and the piece is placed in the furnace for fusion. When the process is completed, the article is taken out, cooled, and the surface rubbed down and polished.

In the *champlevé* process, the spaces for the enamel are dug out with a tool, the raised line of the design thus being a part of the plate itself. The vitreous matter is then introduced into these cavities, the other process being similar to those pursued in preparing the *cloisonné* enamels.

CHINESE VASE.—*Cloisonné Enamel.*

Carrier Pigeons at Great Altitudes.

Experiments were recently made in Switzerland to ascertain whether carrier pigeons would start at great altitudes, and would find their way from summits covered with snow as well as from less heights. Two pigeons were set at liberty on the Bergli, at a height of 8,600 feet. After perching for a few minutes on a neighboring rock, they took flight in the direction of the Eiger; but soon after they returned to the hut whence they had been liberated. They did not start again for some time, when they took the route for their cot, although, surrounded by mountains, they had not seen the country. Of these two, one did not reach its destination till seven days after; the other failed to appear. Neither (it should be said) had been accustomed to be set at liberty at a great distance from its cot. Another experiment consisted in letting off two pigeons (one of which had not been trained for great distances) about 9:30 A.M., at a point 50 feet under the highest point of the Jungfrau, or 13,750 feet above the sea level. They immediately rose, described several large circles, and took their flight down the valley of Lauterbrunnen, in the direction of Schilthorn and Schwalvern. One of these pigeons reached its cot at Thun at three o'clock next day (eight hours after starting). The other did not turn up. The result of these observations is the more interesting, because in several instances pigeons let off from balloons high up in the air have seemed incapable of sustaining themselves, and have fallen to earth like an inert mass.

Extinct American Rhinoceroses.

According to an article by Prof. Cope, in the *American Naturalist*, twelve species of mammals which may be called rhinoceroses, have been described from materials obtained from the Tertiary formations of North America, and five other species have been distinguished which may be regarded as more or less allied to that family. This family of mammals still exists in Asia and Africa, but in Europe it disappeared during the glacial epoch. In North America it became extinct at a still earlier period, no remains of rhinoceroses having been found in beds of later age than the Loup Fork, or Upper Miocene period. In both Europe and America the forms included in the family first appear in the Lowest Miocene or Oligocene epochs; that is, in North America, in the White River formation. The family of *Rhinocerida* is divided into eight genera, embracing some twenty-eight species, six of which are living, and the remainder fossil species. No extinct species of the true genus of *Rhinoceros* has yet been found in North America or Europe, and no extinct rhinoceros of North America which is known, possessed the median dermal horn that we are familiar with in the living animal. The succession of development in the line of *Rhinocerida* is not now difficult to trace; it is probable that the family had its origin from tapiroid animals. The earliest known genus is *Aceratherium*, which is characteristic of the Miocene or Middle Tertiary formations of Europe, and is the primitive form of the true rhinoceroses. The first appearance of dermal horns was apparently in a pair placed transversely on the nasal bones in species of the Eocene tapiroid genus, *Colonoceras*. The same character has been observed in species of the Lower Miocene belonging to the true *Rhinocerida*, and which Marsh has called *Diceratherium*. The latter genus appears to have terminated the line exhibiting this structure, and the family in North America remained without a horn. The genus *Aphelops*, consisting of five species, occupies a position intermediate between *Aceratherium* and *Rhinoceros*, and is distinguished from the latter in the number of premolar teeth, and the absence of horns. The largest known species, *A. crassus*, was found by Dr. Hayden on the Niobrara River, Nebraska.

The other species are more restricted geographically. The types possessing the median horn arose in Europe in the genus *Ceratorhinus* of the Middle Eocene, and still survives. This genus occupies a position intermediate between the last named and *Rhinoceros*. It is evident that the descent diverged here at a comparatively late period of geological time into two lines, which are represented at the present day by the African and Indian species respectively. The earliest species of the toothless or African series is the *Atelodus pachygnathus*. The most specialized type of rhinoceros, the genus *Celodonta*, of the same line, has become entirely distinct. Its three species yet known were confined to Europe and Northern Asia, and the most formidable of them extended its range with the hairy mammoth within the Arctic Circle. The woolly rhinoceros (*C. antiquitatis*) was evidently the most effectively armed of the family, as it possessed two horns, which, judging of the character of the surface of the skull to which they were attached, must have been of unusual size. Prof. Cope observes that a successive increase of size in the species of this line has taken place in North America with the advance of geologic time. Thus their probable ancestors of the genus *Hyrachyus* were the least of all. The *Aceratheria* of the White River formation were larger—the oldest, *A. mite*, being the smallest. The *Diceratheria* of Oregon were larger still; and the species of the Loup River or Upper Miocene formation were larger, and nearly equal to the large existing species.

The Instincts and Emotions of Fishes.

At the opening meeting of the session of the Linnean Society of London, held on the 6th of November, Dr. Francis Day read a paper on the "Instincts and Emotions of Fishes." The study of the subject had, he said, received but very little attention in late years, most naturalists apparently accepting Cuvier's view, that the existence of fishes is a silent, monotonous, and joyless one. This is, however, by no means the case, though we cannot, of course, expect to find special expressions so well marked as in higher animals, because fishes have immovable eyelids, have their cheeks covered with scales, and have no external ears, whose motions in some animals are so expressive. The most numerous recorded observations are those which refer to the regard for the young. Some fishes are polygamous, but among the monogamous there is seen a watchfulness over the young, in which the male often plays as important a part as the female. With several species it is the duty of the male to prepare the nest, as well as to take care of the young. In some classes, which are not nest builders, the eggs are carried about in the cheek hollows of the male. In the case of the stickle back (*Gasterosteus*), the nest, besides being guarded by the male, is gradually opened more and more to the action of the water, and a current is directed over it by a motion of the body. That fishes may be trained to come when called is well known, though as this is generally associated with feeding, it may not be taken to mean much. Cases have been noticed of male fishes remaining at the same spot in a river from which the female has been removed; and, in one case, where a pair were separated for three weeks, they became miserable and seemed near death, while on being reunited they again became happy. In aquaria fishes have been known to attach themselves to particular spots and battles to ensue with intruders. Such combats have been watched, and it has been noticed that while the conqueror assumes more brilliant hues, the conquered sneaks off with his gay colors faded. In their artfulness in obtaining food, fishes show much intelligence, which is more marked with those that eat smaller species, which they entice within their reach. That some classes are capable of an organization for acting together for common good is shown by the way they unite to attack a common enemy. The subject is one that deserves much more attention than it has hitherto received.

Dyes from Mollusks.

In former times some valuable dyes were obtained from shell fish, and of which sepia and the ancient Tyrian purple dye are examples. The abundance of mineral, insect, and vegetable coloring matters which are now available renders these at present quite valueless for industrial purposes, yet some account of them is not without interest. The color known among artists as "sepia" is a liquor contained in the ink bag of *Sepia officinalis*, the cuttle fish. It is of a powerful, dusky-brown color, and works admirably in water, being used in making drawings in the manner of bistre and Indian ink, but is not applicable with oil. Sepia is sold in little bladders, which have to be freed from membranes. This is very easily effected by boiling for a moment in dilute hydrochloric acid, which destroys the envelope, and allows it to be detached by trituration with the hands in water. The bag or pouch being light, floats, and is readily separated on filtration. The black substance which remains is dried, after being washed in hot water. When pulverized finely enough this color is used for water-color drawings; but its hardness renders it necessary to mix it with some foreign color, like sienna, to facilitate the operation of pulverizing. There is great dispute as to the exact source of the once celebrated Tyrian purple, so much used for the garments worn by ancient kings and emperors. Some authorities believe it to have been the product of certain rock lichens, like the "orchella weed" of modern commerce, but the general and most probable opinion is that it was obtained from some species of *Murex* and *Purpura*, the animals of which furnish a rich color. In Britain there are several kinds of mollusks which furnish a dye of this sort; and *Helix janthina*, which is found in the Mediterranean, Atlantic, and South Seas, affords a similar fluid. If the shell of *Purpura lapillus* is broken, there is seen on the back of the animal, under the skin, and near the head, a slender longitudinal whitish vein containing a yellowish liquor. According to E. Schunck, who has investigated this coloring matter (*Chemical News*, No. 39), linen saturated with it and exposed to the sunlight passes from the original yellow through green and blue into purple and scarlet, at the same time exhaling an odor resembling that of assafœtida. This peculiar animal secretion remains undecomposed for years if kept in the dark; but as soon as it is exposed to sunlight, the changes of color make its appearance quite rapidly, without any apparent influence upon it of the presence or absence of oxygen. Chlorine and nitric acid destroy the color, but soap and other acids than nitric are without effect upon it.

By extracting 400 mollusks with alcohol Schunck obtained, in the sunlight, 7 milligrammes of purple. He names this coloring matter *punicin*, and believes it to belong to the indigo group. In ancient times, *Purpura* of the best description were chiefly found on the rocks of Tyre, on the coast of Asia. They were also collected at Mininge, on the Grætulan shore in Africa, and on the coast of Laconia in Europe. The colors varied according to the locality in which they were taken; those from Pontus and Galatia, in the north, produced a black dye; in the equinoctial regions a violet hue predominated; while in the south, as at Rhodes, the color was of a richer red. To make various shades of dye several varieties of shell fish were mingled, for instance, 200 *Buccina* were added to 111 *Pelagia* to make the purple color so much eulogized by Pliny, and one of the three shades of purple recorded by the ancients.

Some of the Tyrian garments had a beautiful play of colors, like the shot silks of our own time; and this, it is said, was first suggested by the similar play of colors on the neck of the pigeon. With the destruction of ancient Tyre the beautiful art of dyeing this peculiar color was lost for centuries, until it was again recovered by scientists of the present day, and the discovery would probably have been of much value to commerce had not the use of it been rendered unnecessary by the discovery of the cochineal insect. The latter, again, has been to a great extent replaced by the discoveries of chemistry in the coal-tar colors. In the reign of Augustus one pound of wool dyed with Tyrian purple sold for a sum equivalent to about $180 of our money. We need not wonder at this enormous price when we consider the tedious nature of the process, and the small quantity of dye obtained from each mollusk. For 50 pounds of wool the ancients used no less than 200 pounds of the liquor of the *Murex* and 100 pounds of that of the *Purpura*, being 6 pounds of liquor to 1 of wool; consequently the rich Tyrian purple fabrics vied in value even with gold.

How Nutmegs Grow.

Nutmegs grow on little trees which look like small pear trees, and are generally over 20 feet high. The flowers are very much like the lily of the valley. They are pale and very fragrant. The nutmeg is the seed of the fruit, and mace is the thin covering over this seed. The fruit is about as large as a peach. When ripe it breaks open and shows the little nut inside. The trees grow on the islands of Asia and in tropical America. They bear fruit for seventy or eighty years, having ripe fruit upon them at all seasons. A fine tree in Jamaica has over 4,000 nutmegs on it yearly. The Dutch used to have all this nutmeg trade, as they owned the Banda Islands, and conquered all the other traders and destroyed the trees. To keep the price up they once burned three piles of nutmegs, each of which was as large as a church. Nature did not sympathize with their meanness. The nutmeg pigeon, found in all the Indian islands, did for the world what the Dutch determined should not be done—carried the nuts, which are their food, into all the surrounding countries, and trees grow up again, and the world had the benefit.

The Cause of London Fogs.

Dr. Frankland has lately concluded an investigation into the cause of the persistency and irritating character of the fogs which afflict the large towns of England, a subject which is rather opportune just now. The fogs are not always a sign of dampness, as they occur in comparatively dry air. Dr. Frankland has ascertained that their persistency in a dry medium is due to a coating of coal oil, derived from coal smoke, upon the surfaces of the minute particles of water which compose fog, the oleaginous coating effectually preventing the evaporation of the water. The oleaginous liquids are discharged into the atmosphere in large quantities during the combustion of bituminous coal in fires. Dr. Frankland therefore concludes that by the substitution of smokeless coal, coke, or gas, for bituminous coal, town fogs would cease. This would be a consummation devoutly to be wished; but considering the vested interests which are concerned in the supplying and using of bituminous coals, and the national preference for blazing fires, the reformation is just as likely to come from the adoption of some of the as yet undiscovered means of heating. But much might be done if the gas companies were more enterprising. Apart from the inconvenience, it is waste of money to be using costly illuminating gas for heating when a gas equally effective for that purpose, but far cheaper, could be obtained. Nor would it be requisite to have a double set of mains, as there are several methods by which such gas could be rendered illuminating at a cheap rate.—*The Architect.*

"Ecarlate."

Among the new coloring matters derived from coal there are few which have a better claim to our attention than "ecarlate." This product has already taken the place of cochineal in a considerable number of its uses, and the moment is not far distant when it may be said that cochineal has had its day.

We shall not enlarge here upon the composition of ecarlate, nor upon the manner of its manufacture.

We have to do merely with the manner of using this new product so as to obtain upon wool a beautiful scarlet equaling grain scarlets both in fastness and brightness. For 100 lb. of wool add to the necessary quantity of water 2½ lb. of sulphuric.

Dissolve in boiling water 1½ lb. of the coloring matter.

Heat the water to about 86° Fah., enter the wool, and work it constantly while the water is raised slowly to a boil.

The dyeing is completed when the beck is exhausted, that is, when it holds no more coloring matter in solution, which is generally effected in about 25 to 30 minutes.—*Moniteur des Produits Chimiques.*

To Dye Straw.

Magenta Red.—The first operation for dyeing this or any other color on straw is to steep the latter in a bath acidulated with sulphuric acid for 12 hours. For magenta, take an acid bath of 4° to 5° Bé. The straw after washing is immersed for 12 hours in a bath kept at 30° to 40° C., containing the necessary amount of dye. Now wash well and dry. Other aniline colors do not dye straw with the same facility.

Maroon, with Logwood.—Clean the straw by boiling with a solution of carbonate of soda, then steep in a bath of logwood for two hours. To give a bluish tint, add some blue stone to the bath; if too much of the latter is used the straw will have a greenish hue. This is a loose color, only employed on account of its cheapness.

Coffee and Chocolate Stains.—If the coffee or chocolate contains milk the stains produced are more pronounced than if prepared with water only, but they are also more easily removed. To remove them, the stains are washed with a mixture of yolk of egg in tepid water. If with this treatment they still remain, add a little spirit to the mixture, and rub with a hard brush.

Blue Linings for Hats.—In producing these the cloth is not dyed, but the thickened color is applied to it in the following manner: Prepare the color with 22 gallons of water, 30 lb. starch, 2 lb. tallow, 44 lb. ultramarine blue; mix, boil, pass through sieve; print on the roller first on one side, then on the other, and dry on the cylinder.

Preparing Steel.

A novel mode of preparing steel has been suggested by Signor Guido, an Italian engineer. It consists in electrolyzing water by means of a dynamo-machine, and smelting the carboniferous ore by reducing it with the oxygen and hydrogen gas obtained, and thus producing either steel or pure malleable iron at will. To turn out two tons daily would, however, require the constant use of a 120 horse power engine.

Softening Processes for Hard Water.

So much of the best water obtained in large districts of England is rendered hard by the presence of an excess of bicarbonate of lime, that an account of the processes by which this hardness can be reduced, and the chalk or limestone waters rendered more available for washing and for some purposes of cooking, will not, says the *Journal of Gas Lighting*, be out of place at the present time. Dr. Clark, of Aberdeen, long ago suggested that the addition of a certain quantity of quicklime, which should combine with the carbonic acid holding the lime in solution in the water, and cause the precipitation of an insoluble powder of carbonate of lime, including much of that which had been held in the water, could be carried on economically, and would be valuable in some cases. He considered that the fine powder would be available for certain purposes in the arts, at least to some extent, and that in this way the cost would be diminished. Dr. Clark pointed out that every pound weight (16 ounces) of chalk consists of 8·64 ounces of lime and 7·36 ounces of carbonic acid, and that the 8·64 ounces of lime (which could be separated by burning the chalk in a kiln) would be soluble in 40 gallons of water. This pound weight of chalk, however, would require 5,000 gallons of water for its solution. He explained also that by combining a pound of chalk (which, as we have seen, already contains 7 ounces of carbonic acid) with another 7 ounces of carbonic acid, the resulting substance (which is now a bicarbonate of lime) would be soluble in 400 gallons of pure water, the result being a water of the same average hardness as ordinary well water obtained from the chalk strata. If, then, 40 gallons of clear saturated lime water containing 9 ounces of lime is mixed with 400 gallons of clear chalk spring water also containing 9 ounces of lime, the ingredients combine, forming 2 pounds of chalk in a light impalpable mud, and leaving clear water above, containing about 1½ grains of carbonate of lime per gallon.

An improvement on this process, which has been adopted on a moderate scale in various places in the manner above described, was some years ago suggested by Mr. Porter, and his modification, called "The Porter-Clark process," was adopted at the new Middlesex County Asylum on Banstead Downs. There, in the early part of 1878, about 6,000 gallons of water per hour were purified, throwing down and separating the impalpable powder as mud with increased rapidity and efficacy, by forcing the water to pass through disks of cloth after being treated with the lime. The operation was, however, both slow and costly.

Dr Clark's process has been adopted at Caterham, Canterbury, Tring, Aylesbury, Redhill, Colne Valley, Swindon, and by the Kent Water Company. In some cases it has been retained, but we do not hear of many recent applications. The rapid accumulation of the precipitate, and the difficulty of so far drying this mud as to render it easy of transport, may be judged of when we remember that for every million gallons per day of chalk water softened, a mass of wet mud, weighing more than two tons when dry, would have to be handled. Thus, to apply the method to the quantity of water now used in the metropolis, assuming it to be all lifted from chalk wells, we should have to reduce to dryness, and afterward deal with nearly 90,000 tons of impalpable powder of chalk per annum. This, however, is not the sole, nor perhaps the most serious objection to the process. The water thus softened has been found to deposit rapidly, in the pipes that convey it to its destination, a mass of minute crystals of carbonate of lime, choking them up, and being very troublesome to remove.

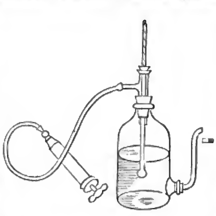
Wherever limestone water prevails, the same objection as to hardness is found to apply to the water that has long remained in contact with the rock. No doubt hardness is uneconomical with regard to the use of soap, but it is more than doubtful whether for drinking purposes it is in any way objectionable. It certainly makes better beer and other fermented liquors than soft water, it is far more pleasant for drinking, and probably more wholesome. Even for infusions such as tea it is hardly inferior, as, while boiling hard water extracts the aroma and the better flavor, it leaves behind the tannin and the coloring matter, which are not desirable or pleasant, and which give the deeper color to tea made of soft water.

The process of softening does not in any way assist in the filtration of water, nor does it remove the earthy yellow tinge of flood waters, or the disagreeable taste of vegetation sometimes observed. In none of these respects does it improve its quality. On the other hand, ordinary filtration through sand, when carefully conducted, does unmistakably improve the quality, and even diminish the hardness of hard water. For practical purposes it may be accepted that on a large scale no better filter material has been discovered than fine, clean, sharp sand. It must, however, be kept clean by frequent scraping and washing, and the washing must be thorough. Filtering sand soon becomes choked in the lower part of the bed when neglected, and the quality of the water passed through soon begins to deteriorate if great care is not adopted, and some expense incurred in reference to clearing the filter beds.

It may be well to allude very briefly to the nature of Dr. Clark's test of hardness, and the meaning of the degrees generally adopted. The test consists in ascertaining the quantity of a standard solution of soap in alcohol that is required to produce a permanent lather when mixed with a given quantity of the water under examination. The solution requires to be made with care and measurement, and the whole value depends on the uniformity of strength of the solution. Each degree of hardness in water is understood to mean a grain of chalk, or its equivalent, dissolved in the water. Thus, a water of 16° of hardness contains 16 grains of chalk per gallon, and 100 gallons of such water would require 32 ounces, or 2 pounds of soap to reduce it to the condition of distilled water. The hardness of water is inferred from the number of measures of soap solution employed, a table being used for reference.

Clarification of Gelatinous Solutions.

A bottle having two necks—one at the top and the other about an inch from the bottom—is procured, and to the lower neck there is fitted, by means of an India rubber cork, a glass tube bent something like the neck of a coffee pot. If a gelatinous solution (not quite free from intermingled air-bells) be now put into the bottle, the necessary temperature being maintained by means of a warm water bath, the air-bells will gradually rise to the surface, after which the clear liquid may be decanted through the spout-like tube. In order to expedite the rising of the air-bubbles to the surface, the upper neck can be connected with an air pump, so that the space over the gelatinous solution may be rendered



vacuous; but in this case it is of course necessary to close the end of the spout by means of a cap or plug of caoutchouc, and it is convenient to adapt a thermometer into the neck in such a manner that the bulb of this instrument shall be immersed in the gelatinous liquid. Both these latter ends may be attained by fitting into the upper neck a glass tube a couple of inches long by half an inch in diameter, and provided with a side branch for connection with the air-pump while the thermometer passes through the upright tube, where it is fixed by an India-rubber cork. A caoutchouc tube with coiled wire inside is convenient for connecting the apparatus with the air pump, as such a tube does not collapse, in consequence of the pressure of the external air.

Here, then, is the complete apparatus ready for use, and I feel sure that any one frequently using or experimenting with gelatinous solutions will find it exceedingly convenient in actual practice. T. BOLAS, F.C.S.

Moulding Mixture for Gelatine Photo Plates.

For moulding the gelatine relief Leipold's mixture may be employed, and by the exercise of care very perfect results may be obtained. The following receipt for Leipold's mixture is taken from Husnik's *Heliographie*: Seventy parts of bitumen are melted at a moderate heat, and to the melted bitumen there are added the following, each being melted previously: 425 of spermaceti, 200 of stearine, and 170 of white wax. All these being well incorporated, 70 parts of finely ground blacklead are stirred in. The plate to be moulded being thoroughly swelled, is removed from the water, dried with a cloth, and gradually raised to as high a temperature as it will bear without injury to any details of the device, this being generally about 35° C. A metal border being now fixed round the edges, the above composition, which ought not to be at a higher temperature than 40° C., is poured on, the composition being allowed to flow over the plate in one continuous wave. The thickness of the layer of composition may vary from half an inch to one inch in thickness, according to the size of the plate, and no attempt should be made to remove the cast until the next day, when it will generally separate with great ease. The mould is next made conducting with bronze powder, and electrotyped. The first electrotype cast obtained should be very slightly oiled, and a second cast made in it will be the required printing plate.

Euphorbium Varnish.

There seems a fair amount of promise in the experiments made with euphorbium varnish as a protective coating for iron. Some years ago the workmen at Natal found that when they cut certain plants of the family Euphorbiaceæ with an iron or steel instrument, a layer of very adherent gum was left upon the blade. The metal so coated appeared entirely protected from rust. Consequently further attempts were made to see if gum euphorbium could not be practically utilized for the preservation of metals. Sheets of iron coated with the gum were plunged into sea water at South Africa, where the well known rapidity of the growth of vegetation exercises a most deleterious action upon iron-coated vessels. As euphorbium can be obtained at Natal close along the sea coast, great facility was offered for putting its anti-corrosive capabilities to the test. The experiments are said to have been completely successful; and with a view of confirming these results, a tincture was made of gum euphorbium dissolved in spirit. This solution was readily applied to the bottom of ships' keels, and to other metallic surfaces. On evaporation of the spirit, the gum was left permanently adherent. Trials of this same preparation made during the past two years at Chatham have shown that iron so varnished remained uninjured after considerable exposure to the corrosive action of the water of the docks. In Africa the gum varnish has proved successful against the ravages of white ants, probably owing to its extreme bitterness.

The New German "Cure" for Phthisis.

For some few weeks past the German medical press has been discussing a new "cure" for phthisis, and accounts, more or less accurate, of the method and its benefits have found their way into the daily and weekly papers, both on the Continent and in this country, and have excited a considerable amount of attention. It is thus described in a letter from Dr Kroczak, the assistant to Professor Rokitansky, of Innsbrück, who has been treating the consumptive patients in his wards by the new method, and, it is said, with results that have far surpassed his expectations; but as yet no definite statistics of the cases and their course have been published:

"Natrium benzoicum—one pro mille of the bodily weight, diluted to a solution of 5 per cent—is inhaled twice a day, in the morning and evening, by means of a well-acting 'Siegle's pulverizator,' without interruption during seven weeks. Besides, the appetite, which will show itself soon, is to be fully satisfied by a meat diet, and fresh air and prevention of all enervating influences are to be insured."

The remedy, therefore, is simple enough. A 5 per cent solution of benzoate of soda is to be inhaled twice daily for seven weeks by means of a Siegle's atomizing inhaler, in the proportion of 1 part of the salt to a 1,000th of the body weight. The quantity necessary for a patient 140 pounds in weight would, therefore, be about 2¼ ounces at each inhalation; and the inhaler must be carefully adjusted for such a large amount to be taken into the air passages. A certain proportion will always escape into and permeate the air of the room, and the patient should remain therein for an hour after each inhalation.

We can easily understand that inhalations of benzoate of soda may be of some benefit in checking the formation of mucus or pus in bronchiectatic and even in phthisical cavities; in fact, the old Friar's balsam has long been, and is still, frequently employed with advantage for this purpose. This, however, is not the result that is to be secured by the new "cure." The benzoate of soda is supposed to destroy the specific bacteria to which the tuberculizing process is due, and then the common inflammatory changes lose their destructive characters and slowly heal. The facts on which such a theory can be based are almost entirely wanting, and few pathologists, in this country at all events, will be found to give in their adhesion thereto, whatever may be the results of the treatment. We should, however, say that the theory has the support of so distinguished a scientist as Professor Klebs, of Prague, and that Dr. Max Schneller, a "privat-docent" in the University of Greifswald, is stated to have failed in inducing tuberculosis in rabbits that were kept for several hours daily in a box which had been filled with these benzoic vapors, although these animals are, as is well known, very readily infected with this disease.

We hope that this treatment may be employed in some selected cases of phthisis, in different stages, so that we may have some trustworthy data on which to found definite conclusions as to its real value. Meanwhile we can only say that *a priori* it seems to us more likely to benefit chronic cases of phthisis with profuse expectoration than those in which true tuberculosis is taking place. It is necessary to add that benzoic fumes are extremely irritating, so that they would be contra-indicated in all cases where there were any signs of irritation in the throat, larynx, and larger bronchi, and that when the vapors are being inhaled, even in the most chronic cases, or in healthy subjects, very distressing cough is likely to come on; and we doubt if many patients will be able to breathe such a large quantity as we have mentioned. Moreover, at present, sodium benzoate is very expensive.—*London Lancet.*

Surgery by the Electric Light.

The London *Lancet* states that Dr. Berkeley Hill recently operated for vesico-vaginal fistula in University College Hospital, while the vagina was lighted up by Mr. Coxeter's application of the glowing platinum wire. The apparatus consisted of a fine wire twisted into a small knot. Through this knot was sent a continuous galvanic current, strong enough to maintain the wire at a white heat. The wire was inclosed in a glass chamber, which was itself also inclosed in another glass cover. Through the space between the glasses, a current of water was allowed to flow in order to preserve a low temperature round the light. The afternoon, which was dark and foggy, afforded a good opportunity of testing this plan of lighting up deep interiors, and the illumination was completely successful. A strong light was maintained for more than an hour, close to the margins of the fissure, without impeding the manipulations of the operator.

The Therapeutical Action of Cold.

BY W. H. THOMSON, M.D., PROFESSOR OF THERAPEUTICS AND MATERIA MEDICA IN THE MEDICAL DEPARTMENT OF THE UNIVERSITY OF THE CITY OF NEW YORK.

Remedial agents are of two kinds: First, drugs; and second, other therapeutic measures, such as temperature, electricity, etc. For the sake of convenience, we will here consider those remedial agents which are not drugs, and first, among them, we will study one of the physical forces or imponderables—cold.

Physically, cold is the absence of heat. Therapeutically, it is a positive agent, and has five actions:

1. Tonic.
2. Styptic.
3. Antiphlogistic.
4. Anæsthetic.
5. Antipyretic.

In the first three cold acts only upon the vaso-motor system as a pure irritant neurotic. In the last two it acts simply on physical principles.

COLD AS A TONIC.

We have said that cold, when it acts as a tonic, is an irritant. Every irritant produces a shock and causes an expenditure of the energy of the part irritated. The energy of the part irritated, therefore, becomes depressed; but this depression differs from that produced by a simple sedative, in that it is followed—provided the shock is not so great as to cause exhaustion—by a *reaction* to or beyond the condition in which the part was prior to the irritation. Thus, cold, as an irritant, affects the vaso-motor system and produces a shock which is followed by a reaction. In other words, this system is exercised, and all moderate exercise tends to strengthen the organ called into action, and permanently to improve its nutrition. Cold, then, is a vascular tonic, and may be used generally or locally. When the circulation is feeble and there is loss of muscular power, the general use of cold will arouse the heart, restore arterial tone, and thereby improve the nutrition of the whole body. For this purpose either the dip, shower, or sponge bath may be used, according to the strength of the patient, taking care never to cause exhaustion by its too frequent or too protracted use. A thorough reaction, as indicated by a glow of the skin, should always follow the bath, and never a sensation of lassitude or fatigue. When the irritant effect produced by the cold water alone is not sufficient, salt or some mild rubefacient may be added. If the patient is too feeble to bear even the sponge bath, simple exposure of the surface of the body to cold air will often prove beneficial. In all cases reaction may be assisted by friction with a rough towel.

A cold douche to the nape of the neck is indicated in the following conditions:

1. When, after sunstroke, the arteries of the head remain dilated, and there is headache and dizziness on exertion or exposure to the sun

2. In all cases in which headache is confined to one side, and is attended by dilatation of one temporal artery and suffusion of one eye.

3. In false croup, or the crowing respiration of children.

4. In tinnitus aurium, when the throbbing is synchronous with the beating of the heart, and the tympanic arteries are distended, the cold douche to the nape of the neck, aided by the internal use of hydrobromic acid, may afford relief.

Sponging the chest of a phthisical patient with cold water lessens the susceptibility to cold.

Local applications of cold water are useful in promoting absorption of inflammatory effusions and exudations in the subacute and chronic stages; also in restoring the balance of the circulation in the liver and spleen when enlarged in malarial poisoning.

The hip or sitz bath is useful in hemorrhoids, prolapse of the rectum, and congestion of the pelvic viscera.

COLD AS A STYPTIC.

As a styptic cold acts by constringing the arteries through its influence on the vaso-motor nerves. It is preferable to astringent drugs or other hæmostatics, because it obviates the necessity of applying irritant substances to the bleeding part. Nor need the cold always be applied directly to the seat of the hemorrhage; for it will also affect distant parts in accordance with the laws of the vaso-motor system, the most important of which are the following:

First.—An impression on the afferent nerves of a given part will cause a variation in the caliber of the arteries of that part.

Second.—An impression on the afferent nerves of a given part will cause a variation in the arteries of all organs situated directly beneath that part.

Third.—In the case of organs which are in pairs and perfectly symmetrical, as the eyes, ears, hands, and feet (the lungs, kidneys, and testicles are not), variations in the caliber of the arteries of one will cause a similar variation in the other.

Fourth.—Variations in the caliber of the arteries of certain parts are accompanied by corresponding changes in the arteries of certain other parts, and these particular associations are to be determined by experiment; for example, the relation between the circulation of the feet and that of the pelvic viscera and the pharynx, and the relation of the circulation at the nape of the neck to that of the head and face.

The following instances will suffice to illustrate the application of these laws in the use of cold:

1. Cold water applied directly to a bleeding surface.

2. Ice-bags to the epigastrium to check hæmatemesis.

3. Holding any cold body in one hand to arrest hemorrhage in the other.

4. Cold foot baths to arrest metrorrhagia.

In post-partum hemorrhage the best means of applying cold is by ether spray, for the sudden and intense impression produced causes effectual contraction of the uterus without chilling the patient. If ether spray is not available, cold water should be poured upon the abdomen from a height of two or three feet, the shock of the falling water materially assisting the action of the cold. Either of the above measures may be used for hæmoptysis.

COLD AS AN ANTIPHLOGISTIC.

As an antiphlogistic, cold may be used to arrest an acute inflammation, unless suppuration has occurred, or to prevent inflammation when threatened. This it does by causing a protracted constriction of the arteries, thereby preventing the active congestion essential to all acute inflammation. It should be invariably applied as dry cold, directly to the part affected, in sufficient intensity to relieve pain, and continued so long as the exciting cause exists. If, before the tendency to inflammation has entirely disappeared, a neuralgic pain occurs, it is a sign that the vaso-motor nerves have become exhausted, and the use of cold must at once be discontinued, or gangrene will result, moreover, the patient will feel more comfortable without than with the cold applications. This neuralgic pain is continuous, and, if the injured part be one of the extremities, it extends from the part injured toward the trunk. Inflammatory pain, on the other hand, is local throbbing, accompanied by local heat, and is relieved by more thorough application of cold.

In fractures, or other severe injuries near joints, the injured parts should be surrounded with pounded ice placed in pigs' bladders or rubber bags, two or three layers of perfectly dry muslin being placed between the skin and bags, lest the parts should be chilled too suddenly. A bottle filled with ice water makes a good antiphlogistic splint for injuries of the hand. Inflammation of the eyes may be controlled, and its spread from one eye to the other prevented, by means of cold applications. Ice bags should be applied to the head and spine in epidemic cerebro-spinal meningitis. Cold applications will control the spread of erysipelas, and are the best means for relieving febrile headache. Headache from uterine trouble is best relieved by moist warmth. Cold should not be used antiphlogistically in any acute inflammation of internal organs, except peritonitis with vomiting, and meningitis.

COLD AS AN ANÆSTHETIC.

The use of cold as an anæsthetic depends upon its physical property of freezing tissue and deadening sensation without injuring vitality. It is most useful in operation where no great thickness of tissue is involved, as in opening abscesses, amputation of fingers, Cæsarean section, and ovariotomy. In all cases the action of the cold should be secured as rapidly as possible. Apply ether spray to the part alone which is to be operated upon. Anæsthesia is complete as soon as the skin becomes white and glistening.

COLD AS AN ANTIPYRETIC.

When the abnormal elevation of the bodily temperature is due to insufficient radiation of heat, as in some nervous disorders, it is not generally in itself dangerous; for it has been known to reach 128° Fah., and remain there for several weeks. But if, as in fevers, the rise of temperature depends upon excessive chemical changes, then the heat itself is injurious, causing arrest of gland secretion, as well as extensive destruction of tissue. In every fever there is a certain point beyond which, if the temperature rises, certain structural changes will take place. The glands become affected with cloudy swelling, and fatty degeneration ensues, and the muscles affected in the same manner become remarkably brittle.

The point at which these changes occur differs in each fever. In scarlet fever it is 105° Fah; in typhoid fever, 106° Fah; in relapsing fever, from 107° to 108° Fah.; and in erysipelas still higher. Beyond this dangerous point in each fever the temperature should not be allowed to rise, but must be lowered by the use of cold, the result of which is simply the abstraction of heat. This may be effected by immersion in a cold bath or by the cold pack. Place the patient in a bath of 75° Fah., and gradually cool the water down to 65° or 60° Fah.—never lower, and at the same time use cold affusions to the head continuously. At first the temperature will rise slightly, owing to the blood being driven from the surface of the body into the viscera, which are always a little warmer than the skin; but the bath should be continued until the temperature is reduced to 100° Fah., provided the fall is gradual—that is, one degree in six, five, four, or three minutes. If it falls one degree in two and a half minutes stop the bath when the temperature has reached 101° Fah.; for in most cases a further reduction of one degree will occur after the bath is discontinued. If the fall in temperature during the bath be one degree in *two* minutes, the patient should be taken out at once, whatever the actual temperature may be, for in such cases there is danger of the subsequent fall becoming uncontrollable, reaching perhaps 97° Fah., and the patient passing into collapse. Should this at any time occur, wrap the patient in hot blankets, apply hot saucers to the epigastrium, and give brandy or other stimulants.

When, for any reason, the bath is impracticable, the cold pack may be used, always, however, with the same precautions as in the use of the cold bath. First wrap the patient in a sheet wrung out of water at an ordinary temperature, say 70° Fah., and then lay on other sheets wrung out of ice water. The cold bath or pack should be repeated often enough to keep the temperature below the point of danger for that particular disease. If necessary, use one every hour. If, however, two or three a day are sufficient, one should be so timed as to be given just before the highest rise of the fever heat—that is, usually between two and three o'clock in the afternoon.

The contra-indications to the antipyretic use of cold are hemorrhage from the bowels and notable variations of temperature from the regular course. Bronchitis and pneumonia are not necessarily contra-indications.

The Physical Cause of Intermittent Fever.

The July number of the *Zeitschrift*, edited by Professor Klebs, contains some particulars of an investigation into the physical cause or poison to which marsh or intermittent fever is due. The inquiry was conducted by Professor Klebs, of Prague, in conjunction with Signor Tommasi, Professor of Pathological Anatomy at Rome. The two investigators spent several weeks during the spring season in Agro Romano, which is notorious for the prevalence of this particular kind of fever. They examined minutely the lower strata of the atmosphere of the district in question, as well as its soil and stagnant waters, and in the two former they discovered a microscopic fungus, consisting of numerous movable shining spores of a longish oval shape. This fungus was found to be artificially generated in various kinds of soil. The fluid matter obtained was filtrated and repeatedly washed, and the residuum left after filtration was introduced under the skin of healthy dogs. The animals experimented on all had the fever with the regular typical course. After explaining minutely the results of their various investigations and experiments, these gentlemen are of opinion that they have discovered the real cause of the disease in question. As the fungus grows into the shape of small rods, Tommasi and Klebs have given it the name of *Bacillus malariæ*.—*Medical Times and Gazette.*

Reappearance of Small-pox in the United States.

The attention of health officers and sanitarians is called to the appearance in the United States of small-pox, and an evident tendency toward its out-cropping in other cities than those in which it has already been noted.

Since the 15th of November deaths from this disease have been reported in the cities of New York, Philadelphia, Washington, and San Antonio. In Philadelphia, with its long immunity from this affection, extending over several years, and in the District of Columbia, there is enough of evidence to show the tendency to spread, previously mentioned, from centers so far removed from each other as to preclude the idea of transmission by actual contact, as a search into the definite origin of the earliest reported cases has as yet failed to reveal any facts concerning either the mode of origin or transmission. The history of the earliest cases thus far reported in Washington are detailed in this number of the *Bulletin*. It is worthy of note here that this disease has existed along our borders for some time—for example, at Montreal, St. Johns, N. B., Havana, and Matamoros—and also that all of the principal cities of Europe have furnished cases—more especially Paris, which has reported 214 deaths since August 21.

A communication from Dr T. C. Minor, health officer of Cincinnati, Ohio, to the National Board of Health, invites the attention of those interested in the prevention of the spread of small-pox and other diseases to the importation as well as the inter-state shipment of rags as a carrier of this and other diseases. Dr. Minor states that rags gathered during the summer from yellow fever infected localities and from infected persons are being forwarded to Eastern points, and also that rags, bedding, and second-hand clothing from cities and persons affected with smallpox may become the carriers of variola from foreign as well as domestic ports to the United States. It is well known that in 1873, in Massachusetts, the origin of small-pox in eleven cities in that State was traceable directly to the importation of rags from foreign or domestic places. No further warning is deemed necessary to be given at present concerning the appearance of this eminently preventable disease.

The sanitary management of the sick with this affection is too well known to every physician to be reproduced here. In view, however, of the probable appearance of this disease in other localities, it is proper to remind every one interested in its prevention and spread that the only absolute preventive measure necessary is *compulsory and thorough vaccination and re-vaccination.*—*Health Bulletin.*

The Healthiest City in the United States.

In the annual tables of vital statistics, lately published by the Health Department of New York city, among the exhibits is the comparative death rate of various cities, American and foreign. The exhibit gives the population and death rate of over three hundred and fifty cities in different parts of the world, of which sixty are American and the remainder foreign.

It appears from these tables that the city of Burlington, Iowa, with a population in 1875 of about 20,000, enjoys the pre-eminence for health, its annual death rate being only 4·84 deaths per 1,000 souls. Stockton, Cal., stands next, 7·47; but this is 63 per cent more unhealthy than Burlington. There are probably a few, but only a few, more favored places than the latter in all the world. The death rate for New York city is 23·93 per 1,000; New Orleans, 50·71; London, 23·40; Paris, 24·71.

NASAL AND BRONCHIAL CATARRH.—A STRONG RECORD.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

NEW BOOKS AND PUBLICATIONS.

THEORIE DES FACHWERKS VON A. FOEPPL. Leipzig: Arthur Felix. 1880. 8vo, pp. 135.

This work treats of the theory of the formation of trusses, and is divided into the following two chapters: 1. The general theory of the formation of trusses; and 2. The special theory of certain defined trusses. In the first chapter the author has very elaborately described the geometrical theoretical formation of trusses and the forces acting upon the same, and shows that the main object of the theoretical calculations is to obtain the values of the pressures and strains in the several joints of a truss. The first chapter closes with a carefully prepared classification of the several types of trusses. The second chapter begins with instructions in regard to the most reliable and most simple methods of calculating the strains in the trusses, the position of the separate loads, and the most unfavorable position of the entire load. Great care has been given to the calculation of the strains in horizontal and arched trusses of well known construction, and of new combinations of the elements, which, although they have not been practically carried out, theoretically surpass all others. The work is carefully illustrated with numerous wood cuts and engravings.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. B. P. asks how to make a "planchette" board. A. A planchette board is simply a small thin board of any desired shape, supported upon three small easily moving casters, and carrying a pencil capable of marking on the surface upon which the casters rest.

(2) G. R. B. asks what is gasoline. It is burned in lamps like gas. I claim it is a dangerous article to use. My neighbor says not; he has a barrel in his cellar. A. Gasoline is one of the lighter distillates from petroleum. It is a very dangerous article to have about the house, as it forms vapor at ordinary temperature, which, when mixed with air, is likely to explode when near a fire.

(3) E. S. asks: What is the best temper for coal picks and drills? A. Heat them to a cherry red, and draw them down to a purple.

(4) J. W. B. asks (1) how to make a whitening solution for silver plating. A. Dissolve 2¼ troy pounds cyanide of potassium, 8 ounces carbonate of soda, and 5 ounces cyanide of silver in 1 gallon rain or distilled water. This solution should be used with a compound battery of 8 to 10 pairs according to the size of the work to be plated. The use of this solution will insure the adhesion of silver to all kinds of brass, bronze, type metal, etc., without employing mercury, the frequent use of which is injurious to the operator. 2. How can I make a finishing solution? A. Dissolve 4¼ troy ounces cyanide of potassium and 1¼ ounces cyanide of silver in 1 gallon rain or distilled water. This solution should be used with one large cell of Smee's battery, observing that the silver plate is placed as near the surface of the articles to be plated as possible.

(5) O. R.—Oil stone powder is preferred to pumice stone powder for polishing fine brass work.

(6) N. A. asks: How can I case-harden small articles of iron? A. Case-hardening, to be quickly performed, is done by the use of prussiate of potash. This is powdered and spread upon the surface of the iron to be hardened. After the iron is heated to a bright red, it almost instantly fuses and flows over the surface; and when the iron is cooled to a dull red, it is plunged in cold water. Some prefer a mixture of prussiate of potash, 3 parts, sal ammoniac, 1 part; or prussiate, 1 part, sal ammoniac, 2 parts, and finely powdered bone dust (unburned), 2 parts. The application is the same in each case. Proper case-hardening, when a deep coating of steel is desired, is done by packing the article in an iron box with horn, hoof, bone dust, shreds of leather or raw hide, or either of these, and heating to a red heat for from one to three hours, then plunging the box into water.

(7) P. T. asks how to bronze small articles of hardware. A. Brown bronze dip, for coating hat hooks and similar small hardware articles, is made of iron scales 1 lb., arsenic 1 oz., muriatic acid 1 lb., zinc solid 10 oz. The zinc should be kept in only when the bath is used. The castings must be perfectly free from sand and grease.

(8) C. P. W. asks how to polish and restore the luster to tortoise shell that has lost its brightness through use. A. First apply rotten stone and oil with a felt wheel or rubber. Finish with the hand.

(9) C. E. B. writes: 1. Suppose a gun is placed in a vertical position so that when it is fired the ball, after having spent its force, will return to the muzzle of the gun on its downward course, will its velocity be the same when it reaches the muzzle as when it left it? A. Nearly so; it will be less by the amount of retardation due to the friction of the atmosphere. 2. Suppose we have two reservoirs, one of which is 1,000 feet in diameter and the other 100 feet in diameter, each round and three feet high and full of water (still water), which will require the strongest walls to hold or which has the greatest pressure on its walls? A. The larger; the pressure on the walls for unit of surface is the same in both, but the larger has ten times the surface. 3. My friend asserts that base ball players can pitch or throw a perfectly round ball to such a manner as to cause it to curve to the right or left as they please; the same with billiards. I say no. I assert that a perfectly round ball cannot be made to curve in that manner in still air. Who is right? A. Your friend. See page 212, Vol. 37, SCIENTIFIC AMERICAN.

(10) W. C. asks: Will any substance that will sink in water sink to the bottom regardless of depth? A. Yes; on account of the slight compressibility of water, the variation of density with the depth is scarcely sensible.

(11) J. W. L. asks if there is any device by which the speed of a pulley can be increased or decreased without changing the speed of the drive wheel, or using the cone shaped pulleys. A. You may use plain cones arranged in a manner similar to cone pulleys. There is a kind of friction gearing sometimes used for the purpose.

(12) D. B. asks: 1. Does speed increase in the same ratio with power? Suppose the power necessary to propel a steamer fifteen miles per hour is represented by 84,540, what would be the speed attained by 1,476,488? A. The power increases approximately as the cube of the speed, hence the speed will be as the cube root of the power. Your speed will be as the cube root of the numbers given representing the power. 2. Is a pressure of 250 lb. per inch practicable? A. Yes.

(13) C. G. D. asks: From which of two engine cylinders can the most power be obtained, one measuring 14 inches by 22 inches, the other 22 inches by 14 inches? A. 22 inches diameter of cylinder by 14 inches stroke, if the figures given are intended for diameter and stroke.

(14) D. G. B. asks: Can you give me a minute description of the construction of the receiving telephone seen in the bottom central figure on page 15 of current volume of the SCIENTIFIC AMERICAN? A. The telephone is the same in principle as Bell's, which has been frequently described in these columns. (See SUPPLEMENT 182.) The only difference is that the magnet in the telephone referred to is curved, and the soft iron core of the helix is screwed into the side of the magnet; and the end which faces the magnet is concaved or made in a cup shape.

(15) "Young Subscriber" writes: 1. The principal of our school says that snow cannot be cooled below 32° F. I don't believe it. Which is right? A. There is no reason why the snow may not be as cool as the surrounding atmosphere, or nearly so. If the temperature of the air is less than 32° the temperature of the snow will also be less. 2. On page 173 of Appletons' "Cyclopædia of Applied Mechanics," it says: "The injector considered as a pumping engine is not an economical machine." Then it says: "As a boiler feeder, however, it is more economical than a steam pump." Is the last of this true? A. The injector is the more economical as a boiler feeder, because the heat of the issuing steam is taken up by the feed water and delivered back to the boiler. 3. How many cubic feet of water an hour, per horse power, does the average steam boiler require? A. Average from 22 to 26 lb. of water.

(16) J. B. writes: I wish to know about raising water to run it by a pipe over a bank. From the water to the top of the ground is, say, 30 feet, and some say it cannot be done over 30 to 33 feet at most. I have never had it explained about the limit of raising only 33 feet. A. There is a possibility of drawing it over a bank 30 feet high from the surface of the water but you cannot do it practically over 26 or 28 feet. The pressure of the atmosphere raises the water, and that with your apparatus perfectly tight could not raise it over about 32 feet. You may so arrange your pump as to draw the water 26 feet and then force it the rest of the way.

(17) R. M. S. writes: 1. I want to drive the boat by foot power similar to velocipede motions and to have gearings connecting the propeller shaft. I want to know how large a propeller a man weighing 150 lb. can drive without much fatigue, also what pitch it should have. How many revolutions should the propeller make to the foot wheel? A. Make your propeller about 18 inches diameter. It should make 7 revolutions to 1 of the foot wheel. Pitch of propeller from 20 to 24 inches. 2. Can you estimate how fast the boat will go in slack water? A. The speed will depend upon the power applied. 3. Which would be best for the wheel, cast iron, brass, or sheet metal, to be light yet strong? A. Use brass or gun metal.

(18) J. A. F. asks: 1. Can crude petroleum be burned in a threshing engine without altering the fire box? A. You need not alter your fire box, but place your apparatus for burning the oil at a proper height. 2. Would it not rid me of the trouble with sparks? A. Yes. 3. About what would be the difference in cost of fuel compared with wood? A. In some experiments compared with coal, it was found to be twice as expensive as coal. You can from this estimate the relative cost of petroleum as compared with wood.

(19) C. H. N. asks: 1. Is "Rose's Machinist," advertised in a recent issue, such a work as you would advise for a young machinist? A. Yes. 2. What railroad office would be the proper one to apply to for a position as assistant civil engineer in construction work? A. The chief engineer of the railroad.

(20) C. L. W. asks whether iron wire can be insulated by coating it with varnish, and if not how can it be insulated? A. It may be insulated with varnish, but a coating of kerite or guttapercha would be far better. If it is to be used in a dry place it will be sufficiently insulated if covered with cotton thread.

(21) J. B. asks: 1. How can I make a small mould from plaster of Paris? I want the casting to be very thin and small. A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 17, contains full instructions for making plaster moulds. 2. How can I make a battery to do silver plating? A. Use a Bunsen or a Smee battery. See directions for making galvanic batteries in SUPPLEMENTS 157, 158, and 159.

(22) V. E. M. asks: Are there as many square feet, inches, and parts thereof in a square measuring 100 feet around (25 feet on each side) as in a circle measuring 100 feet around? If there is a difference please give it. A. To get the area of the square multiply together the length of the two sides, 25 by 25 = 625. To get the area of a circle multiply the diameter by itself and the product by 0·7854. A circle 100 feet circumference is $\frac{100}{3\cdot1416}$ = 31·875 diameter, and 31·875 × 31·875 = 1016; 1016 × 0·7854 = 797·966. So the area of the circle is the greatest.

(23) R. C. writes: 1. I have a well 20 feet deep, with 5 feet of water. My house is 800 feet from the well, with a fall of 4 feet. Can I draw the water with a good pump attached to a windmill at my house and then force it into a tank 20 feet high? A. Yes. 2. Can I lay a pipe from the tank, passing the pipe around the fire box inside of my cooking stove, to supply the kitchen with hot water, without danger of bursting the pipe when the fire is hot and water not being drawn off? A. Yes, if your pipe is large enough to permit a double current. A better plan would be to use a house boiler and connect the pipes to it as in water back ranges.

(24) H. N. R. writes: My main line of shafting makes 300 revolutions a minute. I wish to run a small circular saw mill that requires exactly a reverse motion. Would the use of a gear on main line connecting with one on counter shaft be in any manner objectionable? Is it practicable to run the sawmill with an 8 inch belt with two idle pulleys so as to avoid crossing the same? A. Gearing would be objectionable at so high velocity. If you use belts, it will be necessary to have one crossed, and this should be the one having slowest motion, and it should have a good length. Belts are to be preferred.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. B. R.—No. 1 is finely laminated micaceous schist associated with a small quantity of stratite. No. 2, heavy spar or barite. The specific gravity of the specimen is 4·4. No. 3, limonite, containing about 80 per cent of oxide of iron. No. 4, magnetite, an excellent iron ore.—E. P. L.—No. 1 is not a hydraulic limestone; it might, however, yield a good agricultural lime if properly burned. No. 2, fibrous gypsum.—S. A. M.—No. 1 is iron pyrites. No. 2, hepatic pyrites, in which the sulphuret has been converted into oxide of iron. No. 3, the powder compares very favorably with that of bath brick.—J. R. B.—No. 1 is a readily fusible amphibole. Nos. 2 and 3, specular iron ore, the latter embedded in quartz.—W. M. P.—The powder consists of common salt and a number of other substances in small quantities. It is utterly useless for the purposes for which it is sold. It does not in any way prevent the explosion of light oils.—S. (Denver). Sample No. 1 is a mixture of argentiferous sulphide and carbonate of lead. No. 2 consists of porphyry associated with quartz which carries both silver and gold, probably a San Juan ore. The water in bottle marked F. W. & C. R. B., is of very good quality for potable purposes.

COMMUNICATIONS RECEIVED.

On the Relation of Springs and Barometric Variations. By M. G.

On Planets. By D. S. P.

On Edison's Carbons. By H. R.

On Ice Boats. By W. F. L.

On Life Preservers. By T. R. McC.

On Ice Yachts. By E. O. D.

(OFFICIAL.)

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 23, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Adjustable wrench, S. E. Hurlbut 222,797
Advertising frame, E. J. Morrell 222,894
Air compressor, W. P. Tatham 222,960
Annealing apparatus, E. J. Watson 222,969
Atmosphere, apparatus for moistening the, J. G. Garland 222,889
Axle, car, G. W. Miltimore 222,891
Axles, machine for rounding wagon, A. D. Goodell 222,931
Barrel head, F. G. Johnson 222,791
Bed bottom spring, C. T. Segar 222,935
Beer vessels, automatic pressure relief apparatus for, Zwietusch & Heltmann 222,975
Belt stretcher, A. T. Green 222,886
Bidet and foot bath, combined, M. Church 222,866
Billiard table chalk holder, A. N. Rousch 222,940
Bird cage, B. A. Drayton 222,877
Blind slat securer, G. H. Becker 222,805
Boiler, L. S. White 222,971
Book case, F. G. Johnson 222,911
Boot and shoe polishing machine, L. T. Jones 222,792
Boots treeing, J. E. Crisp 222,774
Bottle stopper, J. B. Miller (r) 9,060
Bottle stoppering device, C. P. Spencer 222,801
Bottles, elastic graduated cap for, J. L. Griffin 222,780
Brick machine, C. A. Bego 222,910
Broom head, E. W. Shippen 222,947
Buckle, W. J. Carnes, Sr. 222,862
Bullet machine, J. Moore 222,920
Bung bush, A. O. Moller 222,806
Burglar alarm, J. Decker 222,873
Burglar alarm, T. Powell 222,940
Button working machine, F. Lasper 222,920
Buttons to cards, machine for securing, S. L. Otis 222,857
Car coupling, J. A. Bovoy et al. 222,755
Car coupling, J. B. & H. H. McCartney 222,806
Car for street railways, baggage, J. Ascher 222,603
Car, railway, M. Nathanson 222,835
Car starter, J. Hill 222,906
Carbine holder, B. Hertzman 222,890
Carburetor, gas, C. A. Howard 222,822
Carding machines, mechanism for stripping the top flats of, G. H. Chandler 222,862
Carpet lining, A. F. Chase 222,813
Casting box, stereotype, M. J. Hughes 222,915
Casting car wheels, G. G. Lobdell 222,922
Chandelier, extension, Clark & Klink 222,771
Cigar box, W. Fredricks 222,778
Cigar holder, C. Robinson 222,941
Clocks, twelve bells striker for, J. Kenmuir 222,913
Clothes wringer, Simpson & Gault 222,800
Cock for fluid pressure brakes, operating, G. Westinghouse, Jr. 222,966
Collar horse, J. T. Turner 222,964
Cooker, steam, H. C. Patterson 222,889
Corset, C. A. House 222,908
Cotton scraper, A. R. Hall 222,846
Cream raising can, W. E. Lincoln 222,825
Cultivator, M. Holdredge 222,783
Cultivator, W. Peedley 222,940
Cultivator and cultivator tooth, C. W. Goodwyn 222,993
Ditching machine, Dunn & Galloway 222,976
Doll supporter, J. S. Goye (r) 9,068
Drills, feed screw for, J. R. White 222,972
Egg stand and holder, T. B. Tattersley 222,962
Evaporating pan, F. Perez de la Tega 222,943
Fabrics, machinery for guiding and stretching, W. Birch 222,854
Fan attachment, W. M. Vestal 222,968
Faucet, J. R. Gathright 222,880
Faucet and cock, W. S. Cooper 222,779
Fence, G. S. Martin 222,935
Fence barbs, die for forming, W. Jenkins 222,976
Fertilizer distributer and seed drill, A. F. Gibboney 222,980
File, bill, Brainerd & Fifield 222,914
Filter, O. Long 222,977
Firearm, magazine, B. F. Joslyn 222,912
Fire screen and blower, combined, W. T. Bradberry 222,960
Folding chair, table, etc., C. J. Everick 222,983
Fruit drier, G. W. Deitzler 222,974
Furnace, F. Perez de la Tega 222,941
Gas analysis, apparatus for, A. T. Schuessler 222,943
Gate, J. D. Shannon 222,936
Gate, J. G. Wilson 222,966
Glass bulbs, tool for opening and shaping the ends of, Jackson & McTighe 222,790
Glass shaping machine, Jackson & McTighe 222,789
Glassware, tool for flaring, O. P. Jackson 222,788
Governor, steam engine, G. F. Futtle 222,946
Grain binder, S. D. Locke 221,829
Grain binder wire spouls, tension device for, T. J. Foster 222,777
Grain binders, compressor and detainer for, O. D. Marie 222,880
Grain meter, W. H. Allen 222,851
Grater, corn, G. Wood 222,974
Grinding mill, roller, W. D. Gray 222,886
Harness loop press, J. L. Barkley 222,850
Harrow coupling, A. B. Campbell 222,864
Harvester, J. S. Marsh 222,928
Hats, manufacture of fur, I. Gill 222,891
Hay rake, horse, W. South 222,948
Hinge, sliding and swinging gate, A. H. Hockaba 222,786
Hobby horse, C. Braeh 222,861
Hog catcher, S. A. Wellman 222,850
Hoops, machine for cutting locks in, P. D. Pike 222,945
Horse tool, A. Randall 222,793
Horseshoe swaging machine, D. J. & S. Farmer 222,810
Hose, C. Callahan 222,770
Hose reel, W. Nemcher 222,836
Hot air furnace, T. F. Hemmich 222,787
Hot bed, B. Middleton 222,936
Inkstand, B. Brower 222,821
Knob attachment, J. J. Dinnan 222,827
Lamps with oil, supplying street, H. S. Belden 222,854
Latch, N. Holmes 222,908
Lathe, button, J. C. & H. J. Terry 222,962
Lathe, button blank turning, J. C. Terry 222,963
Lathe, oval, H. C. Hackenthorn 222,906
Leather, finishing, E. W. Phillips 222,941
Loom, A. Fettis 222,862
Loom, automatic let-off mechanism for, Flanagin & Sager 222,886
Magneto-electric machine, T. A. Edison 222,881
Measure slips, machine for making, A. F. Mollring 222,932
Measuring machine, cloth, A. F. Mollring 222,931
Mechanical movement, F. A. Bishop 222,760
Mechanical movement, J. Davis 222,872
Metal tubes, machine for making, W. C. Allison 222,852
Milk or cream, can for transporting, J. G. Cherry 222,831
Moulding machine, wood, L. Wonchel 222,900
Motion, device for transmitting rotary, M. O. Howe 222,909
Nail counter, W. F. Daniel 222,836
Needles, machine for making, G. Cooper 222,773
Nut lock, W. F. Miller 222,930
Oiling fly nets, harness, etc., device for, L. S. Kurtz 222,827
Organ action, reed, J. H. Chase 222,865
Overalls, I. Lowenberg 222,921
Packing for condenser tubes, J. W. Mead (r) 9,061
Packing, piston rod, A. Wilkinson 222,865
Pantograph, J. J. F. Schnoor 222,798
Paper bags, revolving rack for, J. McMillin 222,932
Paper box machine, A. I. Simmons 222,844
Paper dish and bucket, G. A. Dunn 222,870
Paper, etc., drier, B. R. Hawley 222,921
Pen, J. F. Wallace 222,967
Pen, fountain, W. W. Stewart 222,959
Pianoforte, J. C. Ward 222,849
Planter check row wires or cords, reel for corn, R. H. Avery 222,854
Planter, corn and cotton, R. H. Rhea 222,777
Plow, A. Goodyear 222,804
Pneumatic elevator and conveyer, E. J. Hatch 222,900
Pneumatic motor, Reynolds & Haupt 222,939
Poison upon vegetation, machine for sprinkling liquid, F. I. Marsh 222,903
Poke, animal, G. E. W. Herbert 222,903
Polishing iron, H. J. Welch 222,949
Printing from plates of gelatine, E. Edwards (r) 9,060
Railway tenders, apparatus for supplying water to, T. Leininger 222,918
Reaper, thresher, and separator, combined, R. J. Clark 222,773
Refrigerator, S. W. Loller 222,904
Registering apparatus, E. R. Moffitt 222,401
Rein holder, T. H. Lucas 222,830
Reins, hand hold for, H. B. Powell 222,947
Rocking chair, A. C. Brittan 222,862
Rolling mill, S. R. Wilmot 222,773
Rolling mill feed device, F. J. Slade 222,345
Roofing, metallic, L. L. Sagendorph 222,832
Saddletree, side, J. R. Gathright 222,880
Sash cord guide, T. Van Wagoner 222,967
Sash fastener, T. Powell 222,792
Sash lock, T. F. Lennsouna 222,919
Saw mill, circular, A. Cunningham 222,775
Saw mill head block, D. Lane 222,815
Saw teeth, machine for jointing and dressing circular, W. F. Curtis 222,776
Scraper, road, S. H. Dudley 222,878
Screw driver, W. H. Guthrie 222,781
Seat, E. Edwards 222,880
Separating granular materials, machinery for, G. Conkling 222,815
Sewer building, mould for, J. Burns 222,862
Sewer gas trap, F. Mihan 222,756
Sewing machine button hole attachment, J. W. Blodgett 222,858
Sewing machine shuttle, E. W. Mollihin 222,933
Sewing machine waxing mechanism, S. R. Ellsburg 222,882
Shoe nail, B. Kutigen 222,836
Siphon for sewage and flushing tanks, R. Field 222,889
Skein, G. Mofford 222,897
Skid, J. Hellman 222,898
Skylight, J. L. Oakley 222,938
Slaughter house and apparatus, J. Robertson 222,882
Sleigh, A. J. Wright 222,807
Smoke consuming furnace, J. G. Hunt 222,814
Soda water, etc., apparatus for drawing, W. P. Clark 222,869
Stool, milking, D. A. Le Valley 222,790
Sulky, J. T. & J. V. Upington 222,965
Swimming machine, W. H. Richardson 222,851
Tag, C. E. Sackett 222,804
Tea and coffee pot cover, H. C. Robertson 222,840
Telephone circuit, T. N. Vail 222,966
Thermometer, power, W. D. Grimshaw 222,887
Thill coupling, C. L. Goehring 222,819
Tinner's fire pot, W. S. Boyd, 2d 222,859
Tool handle, H. S. Isham 222,925
Toy knitting machine, J. W. Newcomb 222,937
Traveling bag, etc., frame, Shepler & Hosmer 222,756
Tube thread protector, J. M. Loper 222,900
Tubing water, W. F. Moulton 222,935
Umbrella holder for vehicles, W. M. Demarest 222,875
Valve globe, J. Fowler 222,882
Vault and area cover, illuminating, W. Dale 222,871
Vehicle running gear, J. Herbrand 222,904
Vehicle shifting rail, L. Hullinger 222,923
Vehicles, device for detaching animals from, Whitaker & Partin 222,804
Velocipede, J. W. Gilbert 222,779
Ventilator cap, S. J. Pardessus 222,909
Wash tub attachment, W. M. Stevens 222,946
Washing machine, T. S. McDonald 222,794
Water elevator, T. Leininger 222,911
Water gate, P. S. Basnett 222,808
Watering cattle, apparatus for, T. Leininger 222,916
Well bars, union joint for Artesian, F. H. Kurczyn 222,914
Wells, device for lowering and hoisting earthen tubes in bored, I. Hoover 222,784
Wheel fastener, D. Falb 222,884
Whip socket, E. Chamberlin 222,867
Wire, manufacture of glass-incased, P. Arbogast 222,708
Yoke, neck, P. Rasar 222,889

DESIGNS.

Boxes, D. M. Somers 11,549
Carpet border, T. J. Stearns 11,547
Chairs, J. Partridge 11,551
Coffin handles, W. M. Smith 11,549
Dining chairs, J. Partridge 11,542
Nurse rocking chairs, J. Partridge 11,546
Organ case, H. K. White 11,550

TRADE MARKS.

Marking crayons, Baker, Pratt & Co. 7,793
Medicinal salt, The Corporation Stadtgemeinde Karlsbad 7,792
Soap, Strunz & Wetzel 7,790

English Patents Issued to Americans.

December 12 to December 16, 1879, inclusive.

Electric lamp, T. A. Edison, Menlo Park, N. J.
Electrical signaling apparatus, F. Blake, Jr., Weston, Mass.
Grain binder, elevator, etc., M. A. Keller, Brockport, N. Y.
Lampblack furnace, H. B. Winslow et al., Marblehead, Mass.
Printing press, J. Robbins, Camden, N. J.
Steel welding, W. T. Block, Hanibal, Mo.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

THE BACKUS WATER MOTOR

is the most economical power known for driving light machinery from HYDRANT PRESSURE. POWER given from what is required to run a sewing machine up to six and eight H. P., depending on pressure of water. It takes little room, never gets out of repair, cannot blow up, requires no fuel, and needs no engineer. No delay, no firing up, no ashes, no extra insurance, no coal bills; is always ready. Invaluable for blowing Church Organs, running Printing Presses, Sewing Machines, Turning Lathes, Scroll Saws, Grindstones, Coffee Mills, Sausage Machines, Feed Cutters, Corn Mills, Elevators, etc. Four-horse power at 40 pounds pressure of water. Is noiseless, neat, compact, steady, and, above all, very cheap. Will work at any pressure above 15 lb. Prices from $15 to $200. Send for circular, addressing the manufacturers,
THE BACKUS WATER MOTOR CO., Newark, N. J.

RIGHTS under a valuable patent. Tp., $1; county, $5. Circulars free. BACHMAN & CO., Birmingham, Erie Co., O.

ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free.
T. NEW, 32 John Street, New York.

WOOD SOLE SHOES. The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send for circular to
CHAS. W. COPELAND, 122 Summer St., Boston, Mass.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

TIGHT & SLACK BARREL MACHINERY A SPECIALTY. JOHN GREENWOOD & CO. ROCHESTER N.Y.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

COLUMBIA BICYCLE. A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. It augments three-fold the locomotive power of any ordinary man. Send 3c. stamp for 24 page catalogue, with price list and full information.
THE POPE M'F'G CO., 89 Summer Street, Boston, Mass.

H.W.JOHNS' ASBESTOS

Liquid Paints, Roofing, Boiler Coverings, Steam Packing, Sheathings, Fire Proof Coatings, Cements, &c. Send for Descriptive Price List.
H.W.JOHNS M'F'G CO. 87 MAIDEN LANE, N.Y.

CARNEGIE BROS & CO. UNION IRON MILLS PITTSBURGH PA. WROUGHT IRON BEAMS CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought STRUCTURAL IRON.
It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished on application.

SHEPARD'S CELEBRATED $50 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO., 331, 333, 335, & 337 West Front Street, Cincinnati, Ohio.

The George Place Machinery Agency

Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

20 H. P., $275. "RELIABLE"

Vertical and Horizontal Engines, with Waters' Governor, equal to any in simplicity, durability, and efficiency. Other sizes from 10 to 20 H. P., at prices equally low. For illustrated circular address
HEALD, SISCO & CO., Baldwinsville, N. Y.

A New Year Greeting!

T. Dunkin Paret, having lately returned to this country after an absence of nearly four years in Europe, has resumed sole charge of The Tanite Co., of which he has been for eleven years the President. He expects to improve the quality of Tanite Emery Wheels, giving to some classes greater durability, to some greater freedom of cut, and to all greater uniformity. Owing to the skill and care bestowed upon Tanite Wheels, their price will always be comparatively high. To meet a general demand, he expects soon to introduce a new wheel at much lower prices than those asked for Tanite.

Mr. Paret hopes, by prompt delivery, by fair prices, and by courteous treatment, to keep the trade of all present customers, and to secure many and large orders from that class of intelligent mechanics who appreciate the advantages of STANDARD GOODS.

STROUDSBURG, MONROE CO., PA., January 1, 1880.

Bookwalter Engine.

Compact, Substantial, Economical, and easily managed; guaranteed to work well and give full power claimed. Engine and Boiler complete, including Governor, Pump, etc., at the low price of

3	HORSE POWER	$215 00
4½	" "	245 00
6½	" "	315 00

☞ Put on cars at Springfield, O.
JAMES LEFFEL & CO., Springfield, Ohio, or 110 Liberty St., New York.

Gear Molding without Patterns

Scott's Gear Moulding Machines,
AIR COMPRESSORS & ROCK DRILLS.
DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
FOOT OF W. 13th ST., North River, NEW YORK.
ESTABLISHED 1841.

TRY IT. RUE'S LITTLE GIANT INJECTOR. IMPROVED. THE GREAT BOILER FEEDER. IT IS RELIABLE.

Wheeler's Patent Wood Filler

fills the pores of wood perfectly, so that a smooth finish is obtained with one coat of varnish. Send for circular. Mention this paper.
BRIDGEPORT WOOD FINISHING CO., 40 Bleecker Street, New York.

Patent Steam Friction Crane

Will coal locomotive in three minutes. Two machines will load or unload 1,000 tons per day of coal or ore. The best and cheapest.
NOBLE & HALL, ERIE, PA.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

ORGAN BEATTY PIANO
New Organs 13 Stops, 3 set Golden Tongue Reeds, 2 Knee Swells, Walnut Case, warnt'd 6 years, Stool & Book $98. New Pianos, $143 to $255. ☞ Newspaper sent Free. Address Daniel F. Beatty, Washington, New Jersey.

WIRE ROPE

Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York. Wheels and Rope for conveying power long distances. Send for circular.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

BARNES' PATENT FOOT POWER MACHINERY.
CIRCULAR SAWS, SCROLL SAWS, LATHES, FORMERS, MORTISERS, TENONERS, &c., for actual workshop business.
COMPLETE OUTFITS for Mechanics and Amateurs.
MACHINES ON TRIAL IF DESIRED.
Say where you read this, and send for Descriptive Catalogue and Price List. W. F. & JOHN BARNES, Rockford, Ill.

BOILER COVERINGS.

WITH THE "AIR SPACE" IMPROVEMENTS.
THE CHALMERS-SPENCE CO., Foot E. 9th St., New York. Sole owners of the Air Space Patents.

FALCON'S NON-CHANGEABLE ... LATHE ... FOR MEDIUM ... SEE WORK ... THIRD ST. PHILA.

NEW AND 2D-HAND ENGINES AND BOILERS CHEAP for cash. O. B. GOODWIN, Oil City, Pa.

OPEN BACK PRESSES. STILES & PARKER PRESS CO., Middletown, Ct.

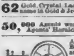
Working Models

And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.

THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

62 Gold, Crystal, Lace, Perfumed, and Chromo Cards, name in Gold & Jet 10c. Clinton Bros., Clintonville, Ct.

50,000 Agents wanted by 1,000 advertisers in the Agents' Herald, Box 5, Philadelphia, Pa.



An engine that works without Boiler. Always ready to be started and to give at once full power.
SAFETY, ECONOMY, CONVENIENCE.
Burns common Gas and Air. No steam, no coal, no ashes, no fires, no danger, no extra insurance. Almost no attendance.

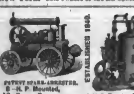
THE NEW OTTO SILENT GAS ENGINE.
Useful for all work of small stationary steam engine. Built in sizes of 2, 4, and 7 H. P. by SCHLEICHER, SCHUMM & CO., 3045 Chestnut Street, Phila., Pa. H. S. Manning & Co., 111 Liberty St., N. Y., Agents.

ELEVATORS HAND POWER AND HYDRAULIC FREIGHT & PASSENGER SHAFTING PULLEYS & HANGERS L.S. GRAVES & SON ROCHESTER N.Y.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO., Publishers SCIENTIFIC AMERICAN.

A REVOLVER GIVEN AWAY.
The largest and costliest Catalogue of Revolvers, &c., in the world, containing exact pictures of nearly every Revolver in existence, a valuable book of reference in itself. Sent free to any address. ☞ $4.50 Revolvers reduced to $2.50. Colt Revolvers, $2.50. Biggest bargains ever known. A Chance for one man in every town in the United States to get a $6 Revolver FREE. Address Essex Repeating Arms Company, 53 Washington St., Boston, Mass., U. S. A.



PATENT SPARK-ARRESTER.		
6-H. P. Mounted,		
10 " "		
12 " "		
	2-H. P. Eureka,	$150.
	4 " "	250.
	6 " "	350.

ESTABLISHED 1840.
Send for our Circulars.
B. W. Payne & Sons, Corning, N.Y.
State where you saw this.

THE PICTET ARTIFICIAL ICE COMPANY, Limited.
Ice Machines to make from 25 pounds per hour to 50 tons per day, at 38 Cortlandt St., New York. P. O. Box 3083.

WOOD WORKING MACHINERY.

PLANING, MATCHING, MOLDING, MORTISING, TENONING, CARVING MACHINES. BAND & SCROLL SAWS. UNIVERSAL VARIETY WOOD WORKERS.
J. A. FAY & CO. CINCINNATI, O. U.S.A.

HARDWOOD LUMBER AND VENEERS.

Mahogany, Rosewood, Satinwood, French and American Walnut, Burl Veneers, Hungarian Ash, Amaranth, etc., etc. Manufacturers will find our stock unusually choice and prices low. Full line of Rare and Fancy Woods planed for Amateur's use.
GEO. W. READ & CO., 186 to 200 Lewis St., New York.

Roots' Rotary Hand Blower,

FOR ALL KINDS OF BLACKSMITHING.
P. H. & F. M. ROOTS, M'f'rs, Connersville, Ind.
S. S. TOWNSEND, Gen. Agt., } 6 Cortlandt St.,
WM. COOKE, Selling Agent, } NEW YORK.
☞ SEND FOR PRICED CATALOGUE.

THE TANITE CO., STROUDSBURG, PA.

EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES AND AIR COMPRESSORS MANUFACTURED BY BURLEIGH ROCK DRILL Co. SEND FOR PAMPHLET. FITCHBURG MASS.

ICE AND ICE HOUSES—HOW TO MAKE ice ponds, amount of ice required, etc., and full directions for building ice-houses, with illustrated plan. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 55. Price 10 cents. To be had at this office and of all newsdealers.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by
WM. D. ANDREWS & BRO., 235 BROADWAY, NEW YORK.

$10 to $1000 Invested in Wall St. Stocks makes fortunes every month. Book sent free explaining everything.
Address BAXTER & CO., Bankers, 7 Wall St., New York.

$3 Printing Press
Prints cards labels &c. (Self-inker $5) 13 larger sizes. For business or pleasure, young or old. Do your own advertising and printing. Catalogue of presses, type, cards, &c., for 2 stamps. Kelsey & Co. Meriden, Conn.

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.

BROWN'S PAT. SPLIT PULLEYS Shafts, Hangers
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

1880. 1880. 1880.

The Scientific American FOR 1880.

THIRTY-FIFTH YEAR.

VOLUME XLII. NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Third day of January, 1880, a new volume will be commenced. It will continue to be the aim of the publishers to render the contents of the new volume as attractive and useful as any of its predecessors.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States, Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 5. [NEW SERIES.] | NEW YORK, JANUARY 31, 1880. | [$3.20 per Annum. [POSTAGE PREPAID.]

APPLICATION OF DYNAMO-ELECTRIC MACHINES TO TELEGRAPHY.

The telegraph, in its importance as a factor in commercial intercourse, in the wonderful rapidity of its development, and in the perfection of its details, rivals anything recorded in the annals of invention. Within the last decade not only have improvements been made which increase the capacity of land lines fourfold, but the cost of working has been greatly reduced. In 1873 the Western Union Telegraph Company sent 14,456,832 messages, at a cost of $6,575,055. In 1879 they sent 23,070,106 messages, at a cost of $6,160,200—considerably less than the first-named sum, while the number of messages sent was nearly double. In 1869 the cost of battery per mile of wire was 117 1-10 cents. By the adoption of improved forms of battery and by various other improvements, the Company has reduced this sum year by year until, in 1879, the cost of battery per mile of wire was only 34 1-10 cents, and now, although this is high economy, the present cost of supplying the electric current is to be reduced 50 per cent by dispensing with batteries and using electric machines.

There are at present on the top floor of the Western Union building 14,300 gravity battery elements, and in an adjoining building there are 4,600 bichromate of potash elements, all of which are to be replaced by electric machines, and the electric current will be generated by the consumption of coal instead of zinc and acid. It is not a new idea to use machines for this purpose, but experiments in this direction, until quite recently, have not proved entirely successful. The new system of current supply, which has been adopted by the Western Union Company, has for the last few months been thoroughly tested in San Francisco, to the satisfaction of telegraph engineers and operators, and recently a set of machines have been put on trial in the battery room of the Western Union Building with satisfactory results. The apparatus consists simply of a number of Siemens machines connected in series, and having their field magnets excited by a current supplied by a single Siemens dynamo-electric machine.

All efforts formerly made in this direction sought to accomplish the object by using a single high tension machine. The potential is now obtained by connecting one commutator brush of one machine with the brush of opposite polarity of the next, and so on, and a current of any desired potential may be had by taking it off from the different machines in the series. A current taken from the first machine in the series will have a low tension; that taken from the second machine will have a higher tension, and so on.

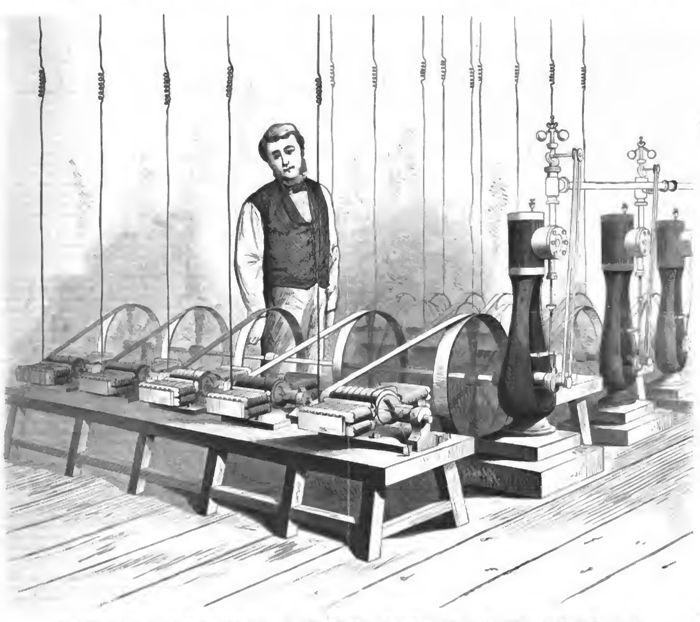
The electromotive force of the first machine in the series is 50 volts; in the second, 100 volts; in the third, 150 volts; in the fourth, 250 volts.

There are three sets of the machines and engines—two sets for working the 360 wires radiating from the Western Union Building, and the cables of the Gold and Stock Telegraph, and one for reserve. The current is equally well adapted to the quadruplex and to the printers of the Gold and Stock Telegraph. These machines and their engines will not occupy a tenth of the room now devoted to batteries, and a single engineer can attend them all.

When this system is thoroughly inaugurated, the batteries will all be removed, relieving the battery room floor of a weight of 60 tons, that being the difference between the weight of the batteries and that of the new plant. The current generated by the machines is to be used for all of the purposes for which battery power is now used, such as annunciators, call bells, small motors, etc., besides working the main lines and local circuits, and in addition to this the Western Union Building is to be illuminated by electricity at an early day.

The Siemens machine is preferred to any other. In its construction it is compact and simple.

The armature consists of a hollow soft iron cylinder provided with brass heads and mounted on the shaft carrying the driving pulley. Around this cylinder a few layers of iron wire are wound circumferentially, and over this are wound longitudinally the insulated wires forming the conductors. There are 56 strands of wire, each of which is



DYNAMO-ELECTRIC MACHINES APPLIED TO TELEGRAPHY.—WESTERN UNION BUILDING, NEW YORK CITY.

wrapped seven times around the iron core, having their termini soldered to bars on diametrically opposite sides of the commutator cylinder. The armature thus formed revolves between the poles of the field magnet, and its commutator cylinder is touched on opposite sides by brushes which take off the current. In the dynamo machine the armature and field magnets are in the same circuit. In the magneto machines which furnish the current to the lines the armatures are in the telegraphic circuit, while the wires of the field magnets are connected with the exciting dynamo.

The application of mechanical generators of electricity to telegraphy must be regarded as a great stride in the march of improvement, as it not only economizes space and means, but it supplies a known quantity in place of an unknown quantity. It replaces the subtile and variable acid and zinc, with the constant and positive power of steam. Without doubt the day is near when batteries will not be found in large telegraphic centers. They will probably be used in local circuits in small offices, but so far as working lines and large central offices are concerned there appears no reason why the machines should not speedily come into general use.

THE WORLD'S FAIR OF 1883.

A meeting to further the movement for a world's fair in this city in 1883, was held in Chickering Hall, January 14. A considerable number of capitalists and other influential gentlemen were present, and letters and telegrams of approval from many prominent statesmen, business men, and others, were read. Addresses were made by Hugh J. Jewett, President of the Erie R. R., Gen'l Joseph R. Hawley, of Connecticut, Senator Windom, of Minnesota, General Chas. E. Hooker, of Mississippi, and others. Considerable enthusiasm was manifest, but no positive action was taken further than to adopt a resolution asking Congress to take measures to give the proposed fair "official sanction and aid commensurate to its importance."

In the course of his remarks Gen'l Hawley said of our patent laws: "They may not be perfect, but they have done more than anything else perhaps to stimulate the ingenuity of the nation. In all the manufactories, a mechanic knows that if he invents something to save time and labor he can get a patent for it and be protected. Of course in carrying out these inventions a great many are shipwrecked, but on the other hand a great many are victorious, and this protection to ingenuity is making us an inventive nation. Another reason is that we are not cursed by the worst features of trades-unionism, which enslaves and cramps the mechanic himself. The unions forbid him to make anything more than his own particular part, and keep down the number of apprentices. These features weigh down with all their force upon enterprise and ingenuity. But you cannot control a Yankee shop in that fashion. If there be an invention the mechanic will be protected, and a manufacturer will run it in his shop if it breaks up all the other places in the land."

ELECTRIC MACHINES IN TELEGRAPHY.

The new and remarkable departure in the art of telegraphy, which we this week chronicle, to wit, the substitution of dynamo machines in place of galvanic cells for generating the electric current, is due to the genius and perseverance of Mr. Stephen D. Field, of San Francisco, Cal.

Various efforts have been made during past years to do away with the cells and their concomitant troubles and expense. Many of the most eminent electricians have turned their attention to the problem, but one and all have heretofore failed to attain the coveted success. The account we give this week of the great change which is now going on within the walls of that great palace of electricity, the Western Union Telegraph Building, shows that Mr. Field's discovery is one of vast importance, for which he is entitled to most generous rewards. His invention has made a complete revolution in the economies of telegraphy, and before a twelvemonth closes it will doubtless be in general use throughout the world. We heartily congratulate Mr. Field upon his splendid achievement. It is one of those brilliant discoveries that is far-reaching in its results and confers a direct, lasting benefit upon mankind.

Good Times for Mechanics.

The Baldwin Locomotive Works are now employing over a thousand more workmen than a year ago, though the last year's work showed the largest production of any year except 1873, when 422 locomotives were built. During 1879 there were built 398, of which 84 were for export, going to Australia, Brazil, Cuba, Norway, Mexico, Guatemala, Peru, Sandwich Islands, and West Indies. The large number of large orders now in hand keep the force employed full time. In every other line of mechanical production the same evidences of prosperity are observable.

Manganese Bronze.

In Prussia there has recently been introduced a new alloy of manganese and copper, which promises to be of considerable importance. "Mangankupfer," as the new bronze is called, consists of 70 per cent of copper and 30 of manganese, and is employed in small quantities to improve common brass, bronze, bell metal, and the like, rendering them, it is stated, more compact, hard, and ductile.

THE late Leonard Case, of Cleveland, left property valued at $1,500,000 for a school of Applied Science in that city.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, JANUARY 31, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 213.

For the Week ending January 31, 1880.

Price 10 cents. For sale by all newsdealers.

THE FUTURE OF ELECTRICITY.

Marvelous as have been the applications of electricity during recent years as a message bearer, light giver, health restorer, and otherwise, it requires no prophetic vision other than that which knowledge gives to foresee an extension of the uses of electricity in the immediate future infinitely beyond anything that the multitude now anticipate. The truth is, men have but barely begun to suspect the capacity of electricity to serve their kind. However numerous the means devised for harnessing the subtile power or great the social changes brought about by its employment, as in the telegraph and the telephone, the vast field for the application of electricity to human affairs has hardly been entered upon.

The best proof of this truth is seen in the varied lines of electric investigation and invention developed during the years just past, each with infinite possibilities, and all marked by surprising discoveries and practical utilizations at almost every step in advance. These lines of research point every way; and it is hard to name a direction of thought or a sphere of practical effort toward which, or into which, electrical investigation is not working or holding out promises of great reward to such as will enter boldly, intelligently, and perseveringly upon the quest.

Men of middle age have witnessed the more remarkable of the stages of social revolution which the utilization of steam has brought about during the past fifty years. Ten years ago it did not seem possible that any power could ever again enable men to repeat the giant strides of progress which steam, in our factories and on the highways of commerce, by sea and by land, had made possible. To-day even greater and more rapid revolutions are impending from the utilization of electricity, and men now living will probably see them brought about.

A few weeks ago we had occasion to speak of the great changes in social and business affairs already effected, and the greater in immediate prospect, through the development of the telephonic exchanges. In every important town such exchanges are in process of development, bringing into vocal communication not only the separate members of widely-extended communities, but also still more widely-separated communities.

Since then a novel and important improvement in a special field of telephonic use has been reported from London. Our readers are familiar with the principle of Mr. Edison's electromotograph or loud-speaking telephone. By employing his small electric motor to turn the chalk cylinder the telephone is made automatic. Instruments of this sort have been placed in, and a large number more are in preparation for, the London *Times* newspaper office; and the reporters of the paper, say in Parliament, instead of reading their shorthand notes to copyists, and transmitting the longhand copy to the printer, as heretofore, now read them directly to the telephone, thus saving the time of copying and carrying the report. In the printing office the compositor sits at a typesetting machine, and, as the report is delivered to him by the automotic telephone, he sets the type as one would play a tune upon a piano. Having no copy to decipher, his whole attention is given to the setting of the type, and another great saving of time is effected. The indications are that by the use of autographic and automatic telegraphy (in conjunction perhaps with stenographic typewriters) reports of public meetings will soon be almost instantly transmitted through long distances and at a fraction of expense which such work now involves. By the same process drawings as well as writings will be transmissible quickly and economically. Such inventions open up lines of progress too far reaching for the boldest imagination to follow.

In this issue of the SCIENTIFIC AMERICAN an account is given of an invention which, in quite a different direction, promises to work great changes in telegraphy. By substituting dynamo machines for batteries in developing the currents used in telegraphing, not only is a great economy effected in the working of the wires, but the larger part of the valuable space now occupied by the batteries is wholly saved. In the central building of the Western Union Telegraph Company in this city twelve tons of machinery take the place of seventy-two tons of battery cells.

The magnitude of the interests affected by an invention like this will be appreciated when we call to mind the fact that the Western Union Company alone requires something near 200,000 miles of wire for its connections in this country. The telegraph lines of all Europe will aggregate something like half a million miles. It must not be forgotten that for every mile of real wire employed in telegraphing the introduction of the quadruplex system gives three miles of "phantom" wire. In other words, the system makes every wire so used equivalent to four wires under the old system; and no one can say how far improvement in this direction is or is not possible.

The future of electricity in the sphere of light giving is daily becoming more apparent. The impossibilities of last year are the achievements of this year; and even if we were compelled to say that hitherto the electric light has not passed beyond the experimental stage, the positive gains made during the past few months are a guarantee that in several directions practical success is assured.

Our readers are already familiar with what Mr. Edison has accomplished. Many other more or less successful inventors are at work upon one or other of the various and very promising systems of electric lighting, both in this country and in Europe. In London a steady and remarkable progress is reported in the working of the Jablochkoff

candles employed at the Victoria station of the Metropolitan Railway and on Waterloo Bridge. A 20 horse power engine already sustains 60 lights (of from 500 to 700 candle power), and 80 lights are promised when another couple of Gramme machines are put down. The length of cable used is upward of a mile and a half, the length of the circuit over three and a quarter miles. It is claimed that the limit of the power of the engine has not been approached. The light already furnished exceeds 1,500 wax candles to the horse power; and yet the margin for improvement is enormous. The actual energy of the coal used is not less than eight times that really developed as light.

In still another direction—the development of thermo-electricity by direct solar radiation, by the utilization of the waste heat of our fires, and the like—the possibilities are incalculable and the work of invention but scarcely begun. In the near future, too, men will draw upon many now neglected sources of power, which will give them through the mediation of electricity a greater supply of motive force than is now derived from all our coal mines. In a recent issue of the SCIENTIFIC AMERICAN SUPPLEMENT the progress made in the utilization of electricity as a carrier of power economically developed in large engines operated by steam power, waterfalls, and the like, was described at great length by Professor Ayrton.

The transmission of power by electricity both for short and for long distances, is not only practicable but economical; and the sanitary and other advantages of drawing power from a distance, for small manufacturing and for operating domestic machinery, are so enormous that the new system is sure to work great changes in all branches of industrial affairs. In every department of life this most nimble and willing servant of humanity is becoming useful, or rather men are beginning to discover how infinite is his capacity for usefulness and the marvelous economies possible throughout his employment. He is as ready to work for us as to run our errands, or watch our property against thieves and fire. And it is no stretch of imagination to say that our children if not ourselves will see the small steam engine everywhere displaced by the electric motor, which will convert into motive power the subtle energy conveyed by wires from central sources of energy—huge furnaces constructed on the most approved scientific principles, out of the way waterfalls, tidal currents, even the sun himself. And doubtless this cleanly and trusty servant will serve humanity in ways we do not dream of now, and at a cost that will be, by comparison with the present cost of light and heat and working energy, almost nominal.

TWO MORE PATENT BILLS.

Two bills to amend the patent laws were introduced in the House of Representatives, December 18, and numbered respectively 3,039 and 3,041.

The first, by Mr. Vance, of North Carolina, provides that any one of the joint owners of any patent for an invention may grant a license to use the invention, but not exclusively, except under the following conditions: (1) When the conveyance or other instrument creating the joint ownership (recorded in the Patent Office before the execution of the license) provides that no license shall be valid unless executed by all the owners, or a specified portion of them in number or interest; or (2) when the joint owners have previously made an agreement limiting the power of the individual owners to grant licenses, and have had the agreement recorded in the Patent Office. The bill further provides for the recording of such powers of attorney, agreements, and the like in the Patent Office, and the use of certified copies of such papers in evidence, as is now done in the case of records of assignments. So far as appears the proposed amendment seems likely to be beneficial.

Not so much can be said of the bill introduced by Mr. Young (H. R. 3,041). Hitherto the American patent laws have wisely regarded inventors as the only parties entitled to the protection guaranteed by letters patent. Mr. Young proposes to extend the protection to those who introduce inventions from foreign countries; but (apparently) only under the curious condition that the art or process to be patented shall have been "used or practiced, unpatented, for the period of fifty years last past exclusively in the country where obtained."

Possibly this is the very thin end of a wedge designed to open our Patent Office to the class of operators known in Europe as "patent sharks," who watch the records of the patent offices of other countries for promising inventions which they immediately proceed to patent as introducers—a sort of industrial piracy which has not been and we trust never will be encouraged in this country.

It is more probable, however, that the parties for whom Mr. Young is working are interested in some art established in a country where patents are not granted—an art which they wish to introduce and monopolize here, or, what is quite as likely, one which they wish to keep from being practiced among us. Under a law such as he proposes any distinctively Asiatic, African, Swiss, Turkish, or South American art, and a wide range of arts which have been practiced too long in either of the several countries of Europe which issue patents to have ever been brought under the action of patent laws, could be patented here, either to work or to suppress. The propriety of granting such great privileges for nothing, or worse than nothing, is not obvious, to say nothing of the probable lack of constitutional authority for such a departure from the principle on which our patent laws are based.

THE TAY BRIDGE DISASTER.

The mails bring no conclusive explanation of the terrible railway disaster at the Frith of Tay. The hypothesis suggested as the most probable, in view of the meager telegraphic account of the disaster—namely, that the bridge was bodily blown away—still seems the most probable. The only point cleared up by the divers is that both the bridge and the train fell together, and that the train had entered upon the fourth span from the south end of the gap before the bridge was overturned. The disaster occurred where the sides of the iron lattice girders rose above the level of the track.

The hypothesis of the constructing engineer of the bridge, Sir Thomas Bouch, is that when the train reached the fatal spot it was tilted over against the girders by a sudden gust of wind, the girders gave way under the strain, and the whole structure broke down under the combined impact of train and storm. This is the best face that can be put upon the terrible affair; not a few engineers, however, are of opinion that the extreme height and narrow base of that portion of the bridge afford a sufficient explanation of its inability to withstand the pressure of the gale. It is certain that the stability of the bridge under the stress of high wind has more than once been seriously questioned. It is even said—though the evidence is not conclusive—that a leading firm, to whom the contract for the construction of the bridge was first offered, declined to undertake it on the ground that a bridge on the plan contemplated could not be made secure. The policy which dictated a single track, and therefore a high and narrow bridge, for such a crossing, proves to have been terribly the reverse of economical.

THE PAST YEAR'S WORK IN THE PATENT OFFICE.

For the first time the year's work of the Patent Office shows a falling off, due undoubtedly to the attempt in Congress last winter to change the law to the injury of inventors. The determination expressed by inventors at the time to withhold applications for patents until assured that their rights would not be laid open to invasion by so doing, thus shows itself. The larger decrease in the number of patents issued may be due in part to the diminished means of the office through the reduction of the appropriations, which reduction, the Commissioner says, has been carried so far as to seriously cripple the office and injure the public interests. The completion and wide distribution of photolithographic copies of the drawings of American patents granted prior to November 20, 1866, and the distribution of English patents for reference in the Examiners' rooms, have aided to a considerable extent the Commissioner thinks, in reducing the number of patents issued.

The statistics of the office for the year ending June 30, 1879, are as follows:

The number of applications for patents was 19,300, being 857 less than the previous year. The number for design patents was 697; for reissue, 639; for registration of trade marks, 1,465; for registration of labels, 631; caveats filed, 2,674.

The number of patents granted, including reissues and designs, was 12,471, being 1,629 less than the previous year. The number of trade marks was 1,144; labels registered, 403; patents withheld for non-payment of final fee, 828.

The total receipts of the office were $703,146.79, being $31,741.19 less than those of the previous year.

The expenditures for the year were $548,651.47. This includes $5,000 appropriated for the repair of models damaged by the fire, and is not properly chargeable to the current expenses of the office.

The expenditures for the previous year were $665,906.02; $50,000 of this being for the repair of models. Excluding the amount appropriated for the repair of damaged models in both years, the current expenditures of the office were $72,254.55 less than those of the previous year. The excess of receipts over expenditures was $154,495.32.

This excess the Commissioner pronounces an unjust tax upon inventors, and favors its reduction either by exacting lower fees or by expending the surplus in improving the facilities for transacting the business of the office. He recommends the latter course. He calls attention to the inadequacy of the rooms provided for the use of the office, and, after insisting that the office needs and ought to have exclusive possession of the entire building, excepting the rooms of the Secretary of the Interior, he recommends that temporary accommodations be provided in that portion of the building now being reconstructed.

The Commissioner further asserts that the interest of the service demands an additional force of clerks and examiners, and to this end he recommends that provision be made by law for ten additional clerks of class one, three of class two, two of class three, one of class four, and fifteen assistant examiners. He suggests also that a portion of the surplus revenues of the office be used annually for the purpose of making additions to the technical library of the office, and for increasing the compensation of the clerks and employés, who, while forced to remain in the lower grade because of inadequate appropriations, are showing efficiency entitling them to higher pay.

Touching the present system of requiring and preserving models the Commissioner makes the pertinent remark that it cannot be permanent, and steps toward a change ought to be taken at once. At the present rate of accumulation there will be more than two million models to house before our second Centennial year, requiring fifty halls as spacious as those now used for storing models. In a few more centuries the entire Federal District would be inadequate to the storage of these evidences of American inventiveness. At the present time models are actually used in the examination of about 50 per cent of the cases in which models are filed. With proper scale drawings from working machines by far the larger part of the models now used might be dispensed with. The Commissioner, therefore, recommends as a first step toward getting rid of models that the following statutory provisions be enacted:

1. That no model shall be required or filed in any case, unless upon a written certificate filed in the case by the examiner in charge of the division to which the invention pertains that it will be useful in the examination of the application, or upon the special order of the Commissioner.

2. That the Commissioner shall not require the production of a model for the examination in any case in which the applicant shall furnish satisfactory scale drawings, made from a working machine, and shall produce for examination a working machine in operation in the city of Washington.

3. That upon the expiration of every patent the model pertaining thereto shall be sent by the Commissioner to one of the public institutions of science and art in the United States.

The only exception that can be taken to these recommendations is, perhaps, in connection with the third. The final disposition of the model might properly be left to the option of the inventor.

To obviate the risk of accidental or fraudulent alteration of models in the manufacture of copies of models for official certification, the Commissioner recommends the enactment of a law authorizing the employment for this purpose of skilled workmen, who shall take the oath of office and give bonds for the faithful performance of their duty.

The Commissioner further recommends that a law be passed authorizing the execution by United States commissioners, or other United States officers, of commissions issued by foreign governments to take testimony in the United States to be used before foreign patent offices and before all judicial, legislative, and executive departments of foreign governments, and to punish perjury committed in such testimony; the law to be operative only in favor of such governments as shall make like provision for taking testimony in foreign countries, to be used in like manner in the United States.

Also that the law relating to the payment of the final fee within six months of the allowance of a patent be so amended as to make the execution of the law possible in all cases. Under the present law, requiring a patent to be dated within six months of its allowance, the payment of the fee on the last day of the prescribed time makes it impossible to conform to the law without resorting to the fiction of a new allowance, made upon payment of the final fee too late to admit of the preparation of the patent before the expiration of the six months. The extension of the time, within which a patent may be dated, to seven months from the date of its allowance would obviate the present difficulty.

German Professors.

In the German universities the professors are men who have distinguished themselves by their contributions to science. They have usually begun their career as "privat docenten," or private teachers, a position unknown in America. If successful, they are made professors extraordinary, and of these a few only reach the distinction of professor ordinary. Any young man of promise, who has obtained the degree of doctor of philosophy (Ph. D.), with honors, can obtain permission to lecture in a given university, provided he passes a good examination in the subject that he intends to lecture on. The university gives him a room to lecture in, and if he succeeds in securing any listeners he gets their fees; beyond this he takes care of himself. His income depends entirely upon his popularity. If his lectures are good, and he proves his ability, his success is assured. In a few years he is called to a vacant chair in the same, or oftener in another, university, where he holds the position of extraordinary professor for years, often for life.

The following list of professors of chemistry in the principal German and Swiss universities embraces many distinguished men whose names are familiar in this country. The figures annexed give the ages of these men, and, as the *Journal of Applied Chemistry* says, they show that most of them are no longer "mere boys:" Berlin, A. W. Hofmann, æt. 61; Bonn, A. Kekulé, 50; Breslau, C. J. Loewig, 76; Erlangen, J. Volhard, 45; Giessen, H. Will, 67; Göttingen, F. Woehler, 79, H. Huebner, 42; Halle, W. Heintz, 62; Heidelberg, R. Bunsen, 67, H. Kopp, 62; Jena, G. A. Genther, —; Königsberg, W. Lossen, 41; Leipsic, H. Kolbe, 61; Marburg, Th. Zincke, 39; Munich, A. Baeyer, 44; Strasburg, R. Fittig, 44; Tübingen, Lothar Meyer, 49; Würzburg, J. R. von Wagner, 57, J. Wislicenus, 44; Zürich, V. Merz, 42.

The oldest of these, Professor Woehler, no longer lectures. He will celebrate his eightieth birthday on the 31st of next July.

Dead at His Post.

A singular, but fortunately not a common, danger of travel was illustrated on the Fulton Ferry, between New York and Brooklyn the other day. A boat was in the slip on the Brooklyn side, and for a few minutes the deck-hands waited, wondering at the unusual delay in starting. Finally two of them mounted to the pilot-house and there found Wm. A. White, the pilot, on the floor, just dead. He had died of heart disease just as he was ready to sound the signal to start the engine. Had he fallen while the boat was in the middle of the crowded river, a very serious accident might have followed.

NEW INVENTIONS.

Mr. Benjamin Honts, of Junction City, Kan., has patented improvements which relate to combined girder and suspension bridges, wherein the girders rest at both ends upon the abutments and are sustained between the ends by cables. The invention consists in combining girders and grooved abutments with cables, screw bolts having nuts and hooks, suspenders, braces, and stays.

Mr. William J Holman, of Fort Wayne, Ind., has patented an improved compound rail for railroad tracks. This invention relates to three-part rails so formed in passing through the manufacturing rolls that they will require no other device, appliance, or attachment to make perfectly secure rails than to place them together and spike them to the cross-ties.

HEATING TIRES BY GAS JETS.

Some time since we gave an illustrated description of the extensive carriage manufactory of Messrs. Brewster & Co., of this city, and in that establishment we find a simple piece of apparatus for heating carriage tires which we do not remember seeing elsewhere. Our engraving conveys a correct idea of the device, and it will require little description to make clear its construction and operation.

A ring of iron pipe is connected by a flexible tube with a gas supply pipe, and projecting from its inner surface there is a number of gas burners, which are articulated so that they may be moved to accommodate tires of different sizes. The tire to be heated is laid upon an iron frame inside the circular pipe, and the gas jets directed against the periphery of the tire. When the tire is sufficiently heated it is removed and set on the wheel in the usual way, another tire in the meantime having been placed within the circle of gas jets.

The efficiency of this device is proved by the fact that a single series of gas jets arranged in this way is sufficient to heat all of the tires which are set in this great establishment.

APPARATUS FOR HEATING TIRES.

Artesian Wells.

Mr. George H. Andrews, a member of the firm of Wm. D. Andrews & Bro., proprietors of the patent for the American tube or driven wells, says that there are over a million driven wells in the United States. In New York and Brooklyn there are over two thousand in leading hotels, factories, breweries, stables, marble-cutting establishments, etc., all of which are reported to us as giving satisfaction. Some idea of their actual value to their owners may be gained from the testimony recently given in court by the president of the New York Gaslight Company, that his corporation was saving $8,000 per annum by the use of the driven well; that he believed $10,000 to $12,000 would be within the mark, but as he wished to keep far within bounds he would say $8,000. Hecker & Brother save from $4,000 to $5,000 by its use in their large flouring mills. Smith's ale brewery gets 60,000 gallons per diem from driven wells; D. Jones' two breweries, 50,000 gallons; F. G. & I. N. Van Fleet, maltsters, of Newark, 75,000; Williamsburg Brewing Company, 30,000; Rubsam & Horrmann, 35,000; N. Leitz & Sons, 20,000; Otto Huber, 20,000; George Bechtel, 20,000; Gluck & Scharmann, 12,000; Myer & Bachman, 15,000—and all these amounts are obtained in only ten hours' pumping.

Some time since it was found necessary to increase and improve the water supply of Newark. Something less than one hundred of these driven wells were put down within an area of four acres, and from them 2,700,000 gallons of water per diem have, during the past six months, been poured into the reservoirs. This water is obtained at a temperature of 53°, is soft, and clear as a diamond. The Newark Aqueduct Board, on the evening of December 26, adopted a resolution setting forth that upon the most careful analysis this water was found to be of excellent quality, and had been of great advantage in improving the city's supply; that 250,000,000 gallons had been furnished by these wells in four months of dry weather without material diminution of the resources; that it was "indispensable to adopt some plan to avoid the dangers arising from the continued use of river water, and also to save the enormous cost of the works necessary to procure a supply from a distant source;" and finally, that it was "expedient and desirable to make arrangements to continue the driven well system on a larger scale," with a view to bringing it into full operation before next summer.

All that has been achieved in Newark is practicable in New York, and in the inexhaustible supply in the depths of the earth beneath our city lies the easiest solution of the problem so frequently recurring of late years, how to make the water supply here adequate to the increasing demands. The average cost of sinking a two inch tube well on Manhattan Island is about $300. That would yield, if required, six to eight thousand gallons of water in twenty-four hours. For a supply of Croton to that amount, by meter, the consumer would have to pay $360 to $480 per annum.

In driving a well at the Passaic Rolling Mills, Paterson, N. J., a remarkable bed of quicksand was lately struck at the depth of 1,180 feet. Mr. Watts Cooke gives in a recent issue of the *Paterson Press* a long and interesting account of the progress of the work. The first 565 feet was through red sandstone, then the drill passed through 44 feet of red shale; that was followed by 6 feet of red sandstone, 30 feet of red shale, and then red sandstone and shale in alternate beds from 6 to 12 feet thick, until the quicksand was struck. The quicksand appeared to be but a few inches thick. The intention is to sink the well from 2,000 to 2,500 feet.

The great artesian well at Buda Pesth, begun in 1868, is now reported finished. The total depth is 3,200 feet, and the temperature of the water is 165° Fah. The temperature of the mud brought up by the borer was taken every day, and was found to increase rapidly, in spite of the loss of heat during the ascent, down to a depth of 2,700 feet. Beyond this point the increase was not so marked. At a depth of 3,000 feet the temperature was 177°, giving an increase of 1° for every 23 feet bored. Water first began to well up at a depth of 3,070 feet, its temperature then being 110°. From this point onward the quantity and temperature of the water rapidly increased. Thus at 3,102 feet its temperature had risen to 150°, and the yield, in twenty-four hours, from 9,500 to 44,500 gallons. Finally, when the boring had reached 3,200 feet, at which point it was stopped, the temperature of the water as it burst from the orifice of the tube was 165°, and the quantity 272,000 gallons in the twenty-four hours. The yield was afterward reduced to 167,200 gallons, in consequence of the bore being lined with wooden tubes, which reduced its diameter.

Ignorance Regarding Machinery.

The general ignorance regarding machinery is surprising when it is considered that machines, in some form or another, enter so largely into the economies of our daily life. The Boston *Journal of Commerce* thinks that newspaper men are especially open to this charge of ignorance, which in their case is the less excusable, as they are expected to "know something about everything." When such mechanical appliances and chemical operations are combined, as in the experiments of Edison, perhaps a lack of definite knowledge may be overlooked; for only a comparatively few specialists are *au fait* on electricity, an agent but recently introduced into our every-day life. But the steam engine—its office and work, and its prominent parts—has been a common possession for generations, and the ordinary tools of the mechanic—the lathe, planer, screw-cutting machines, and other common appliances—are to be seen everywhere, and ought to be familiar to all. Yet the newspaper notices of machinery and tools are seldom correct unless written by a practical mechanic, and sometimes are laughable from their absurdity. A short time ago, in a notice of the derailment of a locomotive by the breaking of a connecting bar between the drivers, it was stated that the piston rod broke, and the end, falling to the ground, lifted the engine from the track! Another account told of the breaking of "the crank of the truck." Latterly we had an account of the "explosion of a steamboat's chimney," and "explosions of engines" are frequently mentioned. One account of a boiler explosion that tore the boiler house and engine room to pieces, gave as a reason why the engine was comparatively uninjured that the engine was not running at the time! The bursting of a fly wheel by the breaking of the governor belt, which stopped it, and allowed the full pressure from the boiler to enter the cylinder unchecked, was accounted for by the too rapid velocity of the governor! The collapse of a flue was called the "bursting of the crown sheet," and the worst explosion of all was the "explosion of a rivet." A notice was recently made of the cracking of the walking beam of a large engine, and the statement was made that the works would stop until a new "shaft" could be cast. A notice of a new marine engine stated that the piston rod ran in ball-thrust bearings—alluding probably to the thrust bearing of the propeller shaft! A description of a large boring lathe conveyed the information that the live cone ran in "rabbeted boxes," meaning, evidently, that the live or head arbor ran in Babbitt metal boxes. A new planer was described as having "ways that run on V frames;" and a screw machine which made machine screws from bars was credited with "threading the heads of the screws," and that process was described as done *after* the screw was cut off the bar. "A solution of bicarbonate of soda," was employed on the screw-cutting tool.

These inaccuracies are in some cases inexcusable, but, in most, a superficial knowledge of a machine, or a smattering of natural philosophy found in common school text books, would have prevented errors so egregious as to raise the laugh of ridicule.

To Remove Nitrate of Silver Stains.

Dr. Kraetzer, of Leipsic, proposes, as a substitute for potassium cyanide in the removal of stains made by lunar caustic or silver nitrate, the following mixture: 10 grammes ammonium chloride, 10 grammes corrosive sublimate, dissolved in 100 grammes of distilled water, and preserved in a glass stoppered bottle. He says that with this solution the black stains may be removed from linen, woolen, and cotton goods perfectly without injury to the goods. It will also remove stains on the skin, but, although less poisonous than the cyanide, it must not be forgotten that it is a corrosive poison. For the skin we prefer to apply tincture of iodine, or a solution of iodine in iodide of potassium, followed by strong aqua ammonia; if slower it is safer both to use and to keep in the house.

THE MANUFACTURE OF SODA.

Soda is now universally manufactured from chloride of sodium (common salt), which is first converted into sulphate of sodium, and is then treated with powdered chalk and coal. Leblanc has introduced the following proportions for this mixture: 100 parts sulphate of sodium, 104 parts of carbonate of calcium, and 30 parts of coals.

If in solution, the sulphide of calcium and the carbonate of sodium can remain without acting upon each other. The results of the operation are variable mixtures of carbonate of sodium, caustic soda, sulphate of calcium, and lime. As the proportions of the carbonate of calcium are varied, the results obtained vary more or less likewise, but generally the quantity of lime used is greater than the quantity given in the theoretical formulae.

The process of making soda may be divided into four distinct successive stages:

1. The reduction of the sulphate of sodium into a sulphide $Na_2SO_4+2C=Na_2S+2CO_2$.

2. The double decomposition of the sulphide of sodium and the carbonate of calcium: $Na_2S+CaCO_3=Na_2CO_3+CaS$.

3. The production of oxide of sodium, due to the partial reduction of the excess of carbonate of calcium, by the coals: $2CaCO_3+2C=2CaO+4CO$. (The quicklime acts upon the carbonate of sodium during the lixiviation.)

4. The production of oxide of sodium, in case an excess of carbonate of calcium is not used, due to the action of the coal on the carbonate of sodium: $CO_3Na_2+C=2CO+Na_2O$.

It is evident that by varying the proportions of the coals and lime, more or less caustic salts and caustic soda may be obtained. The latter branch of industry has been greatly developed in England, particularly since the adoption of the rotating soda furnaces. In France, where the latter are used but very sparingly, the soda salts contain only from 1 to 10 per cent of caustic soda. The first rotating furnace was built in 1853, by Messrs. Elliot & Russel, and has since been considerably perfected by Messrs. Stevenson, Williamson & MacTear.

The furnace as it is generally constructed and as exhibited at the Universal Exhibition of 1878, in Paris, consists of an enormous cast iron cylinder lined with fire brick, and arranged to rotate on the longitudinal horizontal axis, as shown in Fig. 1 of the annexed engravings, which we have taken from *La Nature*. The flames of an adjoining furnace pass into the cylinder at one end and escape at the other, passing through and heating the mass contained in the same. The cylinder is provided with several openings for filling and discharging it. These openings are closed by means of cast plates furnished with locking devices. The revolving furnace does not require any stirring and mixing of the mass as is necessary in the reverberatory or ordinary soda furnace, and it permits of operating much more rapidly.

Both in the reverberatory and revolving furnaces the raw soda forms hard lumps, if the proportions of Leblanc, as given above, are adhered to, and these lumps can only be lixiviated with the greatest difficulty. Mr. MacTear avoided this difficulty by adding about five per cent of quicklime to the mass, thereby obtaining a product that could be very easily lixiviated, for the lime expands as it comes in contact with the water and breaks the lumps into small pieces. A factory in Glasgow, using MacTear's improved revolving furnace and the above improvements in the process, produces fifty tons of soda in twenty four hours.

The lixiviation is carried on in the apparatus and according to the continuous method of James Shank, as shown in Fig. 2 of the annexed engravings. A and B are vats or tanks containing the lumps of raw soda, and are provided with perforated false bottoms; CC are pipes which convey the lye from one tank to the other; by this means it is gradually concentrated and the soda is gradually and thoroughly lixiviated. The lye is evaporated in furnaces, heated by a separate fire or by the waste heat of the soda furnace, until it has the consistency of sirup, which mass is then placed in large crystallizing vessels, subdivided by perforated plates, like sieves. The carbonate of sodium settles on the sieve plates, whereas the impurities are contained in the concentrated lye. In order to obtain the commercial product the carbonate of sodium must be calcined. Mr. Thelen has constructed an apparatus in which the lye is evaporated and the crystals are collected mechanically as rapidly as they are formed.

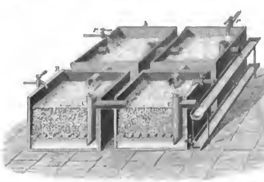


FIG. 2.—APPARATUS FOR LIXIVIATING SODA.

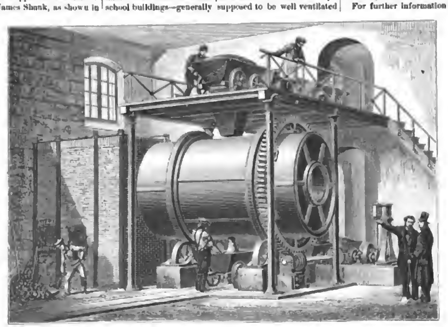


FIG. 1.—REVOLVING FURNACE FOR THE MANUFACTURE OF SODA.

A NEW VENTILATOR.

In comparing the various methods of ventilation, Surgeon General John S. Billings, U. S. Army, who has made ventilation a life study, and other eminent authorities, agree as to the power, capacity, and cheapness of the exhaust fan for the purpose of ventilation. Tall chimneys are useless for the purpose of ventilation without heat when the difference

THE WING VENTILATOR.

between the internal temperature of the house and the temperature of the external air is insufficient to produce a current, and when they are doing their average duty they are far more inefficient than is generally supposed.

From the reports on ventilation in the Barnes Hospital Washington, D. C., for 1876, the chimneys there used showed an average current of less than 200 feet per minute when the fan was not in use. The current is usually much less than this. In the record of ventilation of the Boston City Hospital, December, 1877, and January, 1878, the average velocity of the air passing through ventilators was about 100 feet per minute. In the Brooklyn school buildings—generally supposed to be well ventilated—it is found upon examination that many of the ventilating shafts are absolutely without currents, while some of the buildings, provided with what have been considered efficient ventilators, show a current ranging from 30 to 170 feet per minute, with the rooms heated, and in many of the churches and public buildings in this and other cities it is found that the ventilating flues are, in the majority of cases, either entirely dead or with a downward draught, sometimes being found entirely sealed to stop a downward draught of cold air. This array of facts indicates that the question of ventilation has been hitherto unsatisfactorily dealt with. The ventilator represented in the accompanying engraving is constructed on scientific principles, and is well calculated to fulfill the requirements of an efficient ventilator.

The ventilator shaft used in connection with this device is enlarged as it extends upward, so that each successive story of a building may discharge into it without interfering with the proper ventilation of the lower stories. The cowl into which the ventilating shaft discharges is large and nicely pivoted, so that it turns easily with the wind. Its flaring mouth gives it peculiar advantages over the ordinary form of cowl, so that this of itself is a very efficient ventilator; but the chief merit of this device lies in the arrangement of the fan and its propelling wind wheel seen at the top of the cowl.

All the parts are made to work very freely and with but little friction. The fans are arranged so as to swing around the inner periphery of the casing, leaving an undisturbed central core, while the enlarged hood and vertical position of the fans offer no resistance whatever to the upward current of air in case the fan should not be in motion. In motion they force the air out through the lateral opening, thus producing a vacuum, aiding the natural draught or creating one where there was none.

With the Wing fan ventilator it is found after many tests that when the wind is not strong enough to run the fan, the peculiar form of the cowl, its enlarged size, and prompt action in shifting itself to windward, will give a regular current of from 100 to 200 feet per minute; while with a fair to brisk wind to run the fan the velocity will go up to 300 and 400 feet, while with a strong wind it often records over 500 feet, and has in several cases reached over 600 feet per minute. Six tests made November 20, 1879, at St. Denis Hotel, where there is a 24 inch shaft capped with a Wing ventilator, showed an average of 438 feet, being an actual exhaust of fully 100,000 cubic feet of foul air per hour. December 22, 1879, in public school branch of 15, Brooklyn, six tests showed a current of from 225 to 357 feet per minute, with 8 12-inch pipes leading into two large pipes of 24 inches each, showing an exhaust of over 146,000 cubic feet per hour, with only a light wind and no fires. Later same day the one in Brooklyn *Eagle* building showed a current from 230 to 270 feet per minute. November 20, 1879, the Irving House, where there are two of these ventilators, one over each tier of water closets, gave a current of 525 feet, there being a good breeze.

The inventor gives us an instance in which eggs put last summer in a cold storage house provided with his ventilators had kept until winter perfectly, while those in similar houses without the ventilators had failed to keep in good condition, showing clearly the need of fresh dry air, even in the preservation of eggs. For smoky chimneys or to prevent down draught this ventilator is particularly adapted.

Mr. Wing furnishes us with the names of a large number of persons using his ventilator, and has shown us some very flattering testimonials in regard to its efficiency.

For further information address Mr. L. J. Wing, of the Simonds Manufacturing Company, 50 Cliff street, New York city.

MISCELLANEOUS INVENTIONS.

An improvement in apparatus for drawing and preserving malt liquors, patented by Mr. John Neumann, of New York city, is designed for the purpose of drawing malt and other liquors from a barrel or other vessel, without the admission of air or gas thereto, so that the liquor remaining at any time in the barrel will be prevented from becoming stale.

An improvement in snap hooks has been patented by Mr. John B. Hampton, of Pomeroy, Ohio. This invention relates to an improvement in fastening buckles, loops, and hooks to harness, bridles, etc., and the object thereof is to enable the connection to be made without stitching or riveting.

An improvement in swivels for bridle rein loops, patented

by Mr. John B. Hampton, of Pomeroy, Ohio, consists of a bar adapted to be fastened to the bridle by rivets, having a slot through it and on either side thereof underneath a transverse recess for the reception of the studs projecting from either side of the end of the loop, which are passed through the slot in the plate, and then turned so as to rest in the said recesses, and thus form a swivel joint.

Mr. James McMurray, of East Portland, Oregon, has patented an improvement in cooking utensils. The object of this invention is to provide kettles, saucepans, and other cooking vessels with straining and steaming attachments, which shall be so constructed that they may be readily applied to the said vessels, and attached and detached, as required, and which shall be simple in construction and inexpensive in manufacture.

An improved machine for washing and beating silk and other threads and yarns when in the skein, has been patented by Mr. George Morlot, of Paterson, N. J. It is simple in construction and convenient and effective, removing all loose fibers and foreign particles, and forcing the water into and through all parts of the thread.

An improved tire shrinker has been patented by Messrs. George H. Stroud and John A. Shuman, of Sugar Run, Pa. The object of this invention is to provide a tire shrinker that will work effectually, and yet require no great exertion of power. It consists in combining with a movable plate and jaws a forked connecting rod, pivoted to the jaws, and a lever operated disk.

An improved brake for baby carriages, patented by Mr. William F. Wallberg, of Brooklyn, N. Y., is so constructed as to lock the wheels automatically whenever the handles are released, so that it will be impossible for the carriages to start forward accidentally.

An improved signal lantern, patented by Mr. Thomas S. Easterbrook, of Toledo, O., consists of a lantern globe having two opposite quarter sections colored, and the two intermediate ones uncolored, which globe is set in a lantern frame that has attached to it two quarter section metallic plates that are set opposite each other, so that by turning the globe the colored sections or lights of the globe may be covered by the plates and the uncolored or white lights only be shown, or the colored light be shown and the white be covered.

An improvement in window blind fasteners has been patented by Mr. William H. B. Allen, of Cambridge, Mass. This invention consists in a blind or shutter fastener operating to retain the blind open or closed and fitted for convenient manipulation. The inventor makes use of a pivoted catch and lever hung on the stile of the blind, which locks with the hinge staple to hold the blind in either position.

An improvement in dumping carts has been patented by Mr. George B. Wiestling, of Mont Alto, Pa. The object of this invention is to furnish carts, wagons, cars, and other vehicles so constructed that their bodies may be raised vertically, and also set in inclined positions, to facilitate the dumping of their contents.

The Eclipse of the Sun.

The line of totality of the eclipse of Sunday, January 10, crossed Central California and Southern Nevada, and penetrated nearly to the Great Salt Lake in Utah. Only in California, however, could favorable observations be taken, because the eclipse occurred so near sunset. Prof. Frisby, of the United States Navy, was sent, with a corps of observers, armed with powerful instruments, to the Pacific coast, and Prof. Davidson, with another corps of observers and a 6½ inch equatorial telescope, more powerful than the one Piazzi Smyth lugged up the Peak of Teneriffe, went into the Salenas Valley, which furrows the coast range, about 200 miles south of San Francisco, and within from 15 to 25 miles of the Pacific. Besides these, many private observers made elaborate preparations for observing the eclipse from various points within the line of totality. Apparatus for photographing the eclipsed sun was plentifully provided.

The first report came from Fresno, about 150 miles southeast of San Francisco, and within ten miles of the line of totality. The weather was perfectly clear. The first contact was visible at 2:45 P.M., and at 3:53 the observation became total.

As the last ray of sunlight disappeared, a corona of clear white light, entirely encircling the moon, flashed into view, brilliant at the edge of the moon and paling toward the outer limit of the halo. Next along the border, on the lower left third of the moon, appeared an irregular fringe of brilliant, sparkling primitive red and purple light, while at the top of the moon there was a bright yellow triangle of light equal in height to one-sixth of the diameter of the disk; a similar but smaller triangle appeared at the center of the right side of the moon, and from the upper and lower right side broad faint rays were projected. This appearance lasted thirty one seconds, the corona remaining one minute longer. The sun disappeared behind the coast range before the eclipse had entirely passed.

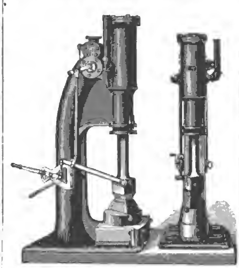
The only other dispatch from parties of observation, up to Jan. 14, came from Prof. George Davidson, of the Coast and Geodetic Survey, stationed at Mount Santa Lucia (5,700 feet above the sea), just south of Monterey, Cal., and but a short distance from the Pacific Ocean. Prof. Davidson says:

"After five days of fierce winds, rain, sleet, and snow, with a temperature of eleven degrees, the weather cleared on Sunday, and we had good observations both at the beginning and the ending of the totality. The totality lasted thirty-two seconds. The shadow was seen coming over the Pacific Ocean. There was a brilliant corona and red flame. Latitude and transit observations were obtained.

The United States Naval Observatory party, under Prof. Frisby, at the same station, are said, in a dispatch from Soledad, to have made successful observations. The first contact was within one and a half seconds of computed time.

IMPROVED STEAM HAMMER.

The annexed engraving represents two sizes of an improved steam hammer invented by Mr. David Bell, of Buffalo, N. Y. These hammers are very simple in construction and substantially built. The single column standard, the cylinder, and the bed piece are cast in one piece. The die block is cast separately and fitted in the bed plate.



BELL'S IMPROVED STEAM HAMMER.

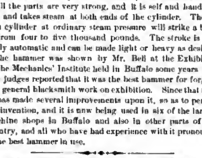
One of the hammers shown in the engraving has an eight inch cylinder and eighteen inch stroke, and the other has a ten inch cylinder and twenty-two inch stroke.

All the parts are very strong, and it is self and hand acting, and takes steam at both ends of the cylinder. The ten inch cylinder at ordinary steam pressure will strike a blow of from four to five thousand pounds. The stroke is perfectly automatic and can be made light or heavy as desired.

The hammer was shown by Mr. Bell at the Exhibition of the Mechanics' Institute held in Buffalo some years ago. The judges reported that it was the best hammer for forging and general blacksmith work on exhibition. Since that time he has made several improvements upon it, so as to perfect the invention, and it is now being used in six of the largest machine shops in Buffalo and also in other parts of the country, and all who have had experience with it pronounce it the best hammer in use.

THE PEERLESS PORTABLE STEAM ENGINE.

The annexed engraving represents a portable engine for agricultural and other purposes, which, in general design, completeness in construction and operation, ranks among the best of its class. It is built with a view to strength, compactness, durability, and efficiency.



THE PEERLESS PORTABLE STEAM ENGINE.

The boiler, which is of the locomotive type, has a fire box of unusual length, and so arranged that the fire is completely surrounded by water. The tubes, which are lapwelded, vary in number in different sizes of the engine, from twenty to fifty-five; in size from two inches to two and a quarter inches; in length from twenty-eight inches to fifty-two inches.

The smoke box, fire door, ash pan, steam blower, smoke stack, and other adjuncts, are neatly and conveniently arranged, and the boiler is provided with the necessary appurtenances, such as steam and water gauges, blow-off cocks, etc. The engine cylinder and the steam chest are combined in one casting, which is bolted at one end to a flange on the end of the frame or bed plate. This arrangement permits of the free expansion of the cylinder, as it rests upon a bracket attached to the boiler, and the boiler is free to expand and contract without straining either the engine or itself.

The saddle or bearings for the crank shaft are of the kind used in first class stationary engines, and are arranged to adjust from four sides, upper, lower, right, and left, with improved simple arrangement by which the bearings can be adjusted by persons who are inexperienced in the use of machinery, cannot be made too tight, and therefore can never be ruined from this cause. The bearings are made very large, and will run a long time before any adjustment is necessary. The support between the boiler and these bearings is cast hollow, through which all the water while cold, used to feed the boiler, must pass on its way to the pump, absorbing the heat which would otherwise cause the bearings and journals to become very hot. This valuable improvement, covering the new feature of a water passage between the boiler and the crank shaft bearings, for the purpose of keeping the journals and bearings cold, is secured by letters patent. When the water is not required in the boiler, the flow is kept up by opening a valve and allowing the water to return to the tank from which it was taken, thus keeping the bearings always cold, and never allowing the pump to become dry, but always working and ready to supply the boiler with water when required.

The engine and boiler can be mounted on a strong substantial truck or wagon, as represented, or on sills. All the parts are interchangeable, and none but the best materials are used, and the workmanship is of the best.

Further information may be obtained from the Geiser Manufacturing Company, Waynesboro, Franklin county, Pa.

MECHANICAL INVENTIONS.

An improvement in speed accelerators has been patented by Mr. James Schofield, of New York city. The object of this invention is to convert slow or slight motion into rapid or extended motion by the intervention of ropes or chains and sheaves, for the purpose of propelling boats, vehicles, machinery, and the like. The invention consists, essentially, of a sliding carriage containing several sheaves, and fixed on a reciprocating rod, while over said sheaves and sets of corresponding standing sheaves fixed opposite, and at a distance, a rope or chain is passed back and forth in such a manner that a slight movement of the carriage will produce a very extended or accelerated movement of the bight of the rope or chain, or of objects attached to it.

An improvement in vehicle-wheel hubs has been patented by Mr. Lucius S. Edleblute, of Cincinnati, Ohio. This invention is an improvement in the class of metal wheel hubs in which the spoke tenons or butts are clamped between flanged collars, one of which is adjustable on the axle box to adapt it for convenient adjustment or removal, and it pertains to a peculiar construction and arrangement of parts which cannot be clearly described without an engraving.

Mr. Benjamin Shuser, of Sidney, Ohio, has invented an improved elevator for warehouses and other buildings, constructed with a view to securing greater safety against the sudden fall of the elevator platform from the breakage of the rope, and to provide against persons falling through the hatchways in the several floors. The invention consists in a novel automatic clutch for arresting the descent of the platform in the event of the sudden breakage of the rope, and in the peculiar means for opening and closing a set of automatically operated trap doors for the hatchways, which are opened above and closed after the platform in rising, and also opened below and closed above the platform in descending, so that at no time is the hatchway left open.

Mr. Lovren E. Hogue, of Sandy Lake, Pa., has invented an improved injector in which the lifting and forcing tubes are so constructed and arranged with regard to each other that the pressure may range from forty to one hundred and fifty pounds without requiring any change in their adjustment, the said construction and arrangement enabling the quantity of water to be so graded that three or more different quantities of water may be injected into the boiler.

The New Industrial Art School.

The new free school for workers in metal and wood was opened January 13, at No. 31 Union Square, under the management of the trustees of the Metropolitan Museum of Art. The object of the school will be to teach carvers in wood, engravers on gold, silver, steel, and other metals, and others how to design artistically, so as to do away with the old-fashioned method of designing from copy, and in this way to enable the workers to obtain higher prices for their work. The project had been long before the trustees of the Metropolitan Museum of Art, and the establishment of the school is due in great measure to the efforts of Messrs. Robert Hoe, Jr., William L. Andrews, W. E. Dodge, Jr., and Edward C. Moore and Professor Thomas Egleston. The school will be open from 7:30 to 9:30 P.M. The first class will be for workers in wood, and the above named gentlemen have invited workmen from the art establishments of the city who possess a knowledge of drawing and who wish further instruction to attend. A class for workers in metals has also been organized. The students will be allowed to copy from models brought from the collections of the museum. Many manufacturers have promised to do all they can toward making the school a success.

The industrial importance of schools of this nature can scarcely be over-estimated. Wherever they have been undertaken they have shown themselves the most efficient aids in raising the character of industrial art and the social and financial condition of the artisan. It is to be hoped that the young artisans of New York will be prompt to avail themselves of the privileges now offered them.

The Shells of Pompeii.

Dr. Nicola Tiberi, an excellent naturalist, living at Resina, close to the site of Pompeii, has recently published a remarkable and well written memoir on the shells found in the ruined city. The point of view to which he directs attention is very different from that taken by the geologist, antiquary, artist, or architect. He treats of the shells found in the ruins, and which had served for food, or had been used by the Pompeians for ornament and other purposes. We know from Athenæus and other ancient authors that mollusca were then relished quite as much as they are at the present day by the inhabitants of Italy. Dr. Tiberi gives a list of all the shells which he has noticed as Pompeian, belonging to no less than 44 species, with particulars of their relative abundance at Pompeii, as well as of their distribution and economy. Some were of edible kinds, as the common oyster and mussel, *Pecten jacobæus*, *Venus chione*, *Tapes decussatus*, and several species of *Helix*. Others served to adorn fountains, as *Haliotis tuberculata*, *Murex trunculus*, and *M. brandaris*. The Oriental pearl shell (*Meleagrina margaritifera*) was represented by a single valve only.

But the ladies of Pompeii seemed to have attached considerable value to the *Cypræa*, or cowry, as amulets or charms to prevent sterility; and among these shells were some of the species from the Red Sea and the Persian Gulf. A single specimen of another exotic shell (*Conus textilis*) must have been kept for its great beauty as an object of curiosity. All the shells used in the ornamentation of fountains, five in the city and one in the suburbs, are of species which are still common in the Gulf of Naples; and these shells are separately distinguished and named. The memoir, which is a quarto pamphlet of twelve pages (*Le Conchiglie Pompeiane*, Napoli, 1879), forms a short but interesting chapter of Roman history, and tells us more than is generally known about the habits of the former masters of the world.

To Convert Common Agate into Onyx.

Following the attempt to produce minerals and precious stones artificially, comes the attempt to convert one mineral into another, a less costly into a more valued gem. Two Germans have patented a process for converting ordinary agate into onyx. Lorenz and Cullmann place the cut and polished agates for a week in a solution of iron in nitric acid only one millimeter deep, and then treat those portions of the stone which are to be white with a solution of equal parts of carbonate and hydrate of potash, dried, and burned in an earthen pot until the desired color is obtained.

Cannot some of our readers devise a method for converting ordinary feldspar, orthoclase, into Amazon stone? The latter has a bright emerald-green color, which is destroyed by heat, but brightened and intensified by certain hydrocarbons, like turpentine oil.

Different Solvents for Pyroxylene.

In the preparation of collodion the gun cotton, or pyroxylene, is dissolved in a mixture of alcohol and ether; in the manufacture of celluloid the solvent is camphor. Bardy, the celebrated French chemist, has recently studied the action of other solvents, especially aceton, methylic alcohol, and glacial acetic acid. His results, as reported to the Photographic Society of France, were as follows:

Aceton, a liquid which resembles ether in its volatility, but unlike the latter miscible in all proportions with water, is one of the best known solvents of pyroxylene. It does not dissolve the firm cotton prepared at low temperatures as well as that in dust form made by Martin's process. On pouring the aceton solution into water, the solvent at once unites with the water and the cotton is precipitated in the form of large white flakes, which do not adhere together, and hence can be easily washed. When dry this cotton has a peculiar appearance; three grains of it occupy a space of nearly 200 c.c. It is not actually necessary to employ the pure aceton; if it gives no milky precipitate when poured into water and does not reduce salts of silver it is good enough.

Methylic alcohol, since its introduction into the manufacture of methyl violet, comes into commerce in a state of sufficient purity. It mixes with water in every proportion, and has no action upon silver salts. It dissolves pyroxylene easily, but the solution is more shiny than that in aceton. If poured at once into water it is precipitated as a compact gelatinous mass, difficult to wash out. The solution must be poured into cold water in a very fine stream, then a very voluminous mass is obtained; 25 grains occupy 2 liters of space, and can be readily washed out. On drying, the mass becomes horny, half transparent, and of an amber color. It dissolves readily in the mixture of alcohol and ether.

Crystallizable or glacial acetic acid dissolves pyroxylene, and when poured into water the solution acts like the aceton solution. On drying, every trace of the acetic acid is volatilized, leaving the cotton perfectly neutral. I. Z.

MANY persons know it, but some do not, that a pretty and easily grown window plant may be obtained by soaking a round piece of coarse sponge in warm water until it is thoroughly expanded. After squeezing it about half dry, place in the openings millet, red clover, and barley grass seeds, rice, and oats. Hang the sponge in a window where the sun shines a part of the day, and sprinkle it lightly with water every morning for a week. Soon tender leaves will shoot out, and, growing rapidly, will form a drooping mass of living green. If regularly sprinkled, it will later be dotted with the blossoms of the clover.

On a Curious Case of Crystallization in Canada Balsam.*

BY GEORGE F. BARKER.

Some time in the early spring of 1875, a party of hunters left Rawlins, Wyoming Territory, and went up into the Sweetwater country, a hundred miles north of that town, in search of game. While absent one of the party lost a valuable field glass. In the summer of 1878 a party of Ute Indians came into Rawlins, having in their possession the lost field glass. It had lain out exposed to the weather for over three years, and of course showed the hard usage it had undergone. The eye lenses, however, were in excellent condition, but the achromatic object glasses were covered with an abundant arborescent crystallization, which rendered them quite opaque. My friend, Mr. Galbraith, of Rawlins, who had become their owner, first called my attention to them, and, supposing the crystallization to be in the glass itself, he sent one of the lenses to me as a pattern, in order to have a pair of new ones made in place of the spoiled ones. On examining the lens, however, in connection with Mr. Zentmayer, it was evident that the crystallization was not in the glass, but in the Canada balsam used for cementing the components of the achromatic. At my request, therefore, the second lens was sent to me, so that by cleaning off the old balsam and recementing, both would become perfect again. The crystalline forms of this second lens were so beautiful that I desired to preserve them. So I applied to Mr. E. L. Wilson to photograph them for me. He took a warm interest in the matter and produced four negatives, one of the first and less beautifully crystallized lens, and three of the other one, each with a different illumination. I present to the Section prints from these exquisite photographs. (The accompanying wood cut has been engraved from one of the best of these photographs.) It will at once be seen on inspection that these arborescent forms are of great beauty, the fineness of the subdivisions being quite remarkable. The most curi-

ous thing about these forms, however, is the fact that they are themselves hollow and are surrounded by the crystallizing material, the balsam. Hence the supposition that we have here the crystallization of some constituent of the balsam is at once negatived. Canada balsam, as is well known, is a complex mixture of two or three resins dissolved in a volatile oil. Now, since one of these resins is crystallizable, it might be supposed that during the intense cold to which the glass was exposed, this resin had crystallized out in these forms. But in that case the crystals would be solid, not hollow. So also of the suggestion that this is a frost-like or dendritic crystallization of some infiltered material. The crystals in that case would also be solid, unless we suppose their subsequent removal leaving the cavity. But a close examination of the branchlets with a glass shows that they have been formed by a gradual withdrawal of the crystallizing material from several nuclei simultaneously, thus becoming the centers of the radiations. This is evident from the curved lines in the larger branches, concentric with their rounded ends. The most probable hypothesis is that the crystallization has been induced or directed by some constituent of the balsam itself. But the precise conditions under which it has taken place do not seem clear. The building up of a crystal by the aggregation of molecules according to their polarities, or the demounting of a crystal by solvents in regular forms, is simple in comparison. The branchings do not take place at right angles, it will be noticed, but at 30°, which suggests hexagonal crystallization.

* Read at the Saratoga meeting of the American Association for the Advancement of Science.

Cameo Shells and Cameo Cutting.

The word *cameo* is derived from the Arabic, and is equivalent in signification to bass-relief. It was originally restricted to hard stones, such as onyx, sardonyx, etc., engraved in relief, but the term has since been extended to include gems cut on shell, lava, and other substances. Certain descriptions of univalve shells are well adapted for cameo cutting, from their substance being made up of different colored layers, and also from a difference of hardness and texture, and the various layers—some approaching more nearly to the nature of a nacreous than of a porcelanous material. The good workman always carefully puts his work on the shell in such a manner that the direction of the laminæ of the central coat is longitudinal. In cameos the central layer forms the body of the relief, the inner layer being the ground, and the outer the third or superficial color, which is sometimes used to give a varied appearance to the surface of the figure. The cameo cutter selects from the shells which possess the three layers: (1) those which have the layers strongly adherent to each other; (2) those in which the middle layer is thick; (3) those in which there is a good distinction of color between the layers; and (4) those in which the inner layer is of the color suited for his purpose.

The kinds of shells now employed, and which experience has shown to be best for the purpose, are: The "Bull's Mouth" (*Cassis rufa*), which has a *red* inner coat, or what is known as a *sardonyx* ground; the "Black Helmet" (*Cassis Madagascariensis*), which has a blackish inner coat, forming what is called an *onyx* ground, and which shows up white on a dark claret color; the "Horned Helmet" (*Cassis cornuta*), white on an *orange-yellow* ground; and the "Queen Conch" (*Strombus gigas*), with a *pink* ground. The latter shell is about ten inches long, with a rose-colored aperture and an extremely broad lip rounded above. The bull's mouth and the black helmet are the best shells, for the horned helmet is apt to separate from the ground, or to "double," as the French workmen express it. The queen conch seldom has the two colors distinctly marked from each other, and the pink of the ground fades on exposure to light. The red color of the bull's mouth extends but a short distance within the mouth of the shell, and becomes paler as it proceeds inwards. Hence this shell affords only a single cameo large enough for a brooch and several small pieces for shirt studs, while the black helmet furnishes on an average about five brooches and several stud pieces. The queen conch yields only a single good piece. *Cassis flammea*, which is about six inches long, and *C. decussata* and *C. tuberosa*, which are white upon a dark claret color, are also occasionally used. The bull's mouth shells are derived from India and Ceylon, and the black helmets and queen conchs from the West Indies.

Genoa and Rome are the seats of the best work in cameo cutting, although many common ones are cut in France. In Rome there are about 80 shell cameo cutters, and in Genoa 30. The art of cameo cutting was confined to Rome for upwards of 40 years, and to Italy until the last 26 years, when an Italian began the practice of the art in Paris, and now over 8,000 persons are employed in the industry in the latter city. In the practice of cameo cutting the shell is first cut into pieces the size of the required cameo by means of diamond dust and the slitting mill, or by a blade of steel fed with emery and water. It is then shaped into a square, oval, or other form on the grindstone, and the edge finished with oil stone. It is next cemented to a block of wood, which serves as a handle to be grasped by the artist while tracing out with a pencil the figure to be cut on the shell. The pencil mark is followed by a sharp point, which scratches the desired outline, and this again by delicate tools of steel wire, flattened at the end and hardened, and by files and gravers for the removal of the superfluous portion of the white enamel.

The careful manipulation necessary in this work can only be acquired by long experience; the general shape must first be wrought, care being taken to leave every projection rather in excess, to be gradually reduced as the details and finish of the work are approached. Throughout the cutting great caution must be observed that in removing the white thickness the colored ground is not damaged, for the natural surface of the dark layer is far superior to any that can be given artificially.

In order that the finished cameo may possess a distinct outline at all points of view, it is desirable to adopt the system followed in antique cameos, viz., to leave all the edges of the figure quite square from the ground, and not gradually rounded down to the dark surface; for should the latter practice be followed the outline would be found to be undefined in many places, owing to the color of the white figure in relief gradually merging into that of the dark ground. The surface of the cameo is finished as nearly as possible with the cutting tools, as all polishing with abrasive powders is liable to remove the sharp edges of the figures and deteriorate the cameo by leaving the form undefined. When, however, the work has been finished as smoothly as possible with cutting tools, the final polish may be given by a little putty powder used dry, upon a moderately stiff brush, and applied with great care, and rather to the dark ground than to the carved surface. This is the concluding process, after which the cameo is ready for removing from the block prior to mounting.

The various styles in which these works of art are mounted depends a great deal upon the country where they are to be worn. There are tricks in this business as well as in most others; a fraud is frequently practiced by cutting away the engraved part of old shell cameos, and attaching this to a base of agate, by means of which an appearance of onyx is obtained.

As an illustration of the prolific capabilities of our inventors we may say that over 240 patents appertaining to the art of soldering have been granted. In Canada only two patents of the kind have been issued.

AGRICULTURAL INVENTIONS.

Mr. John P. Smith, of Claverack, N. Y., has patented an improvement in thrashing machines for which letters patent No. 53,694 were issued to him April 3, 1866. The improvement consists in so combining a perforated apron and concaves with the rotary cylinder of a thrasher as to create an upward blast through the apron to lift and assist in carrying the straw to the cylinder.

An improvement in cotton scrapers, choppers, and dirters has been patented by Messrs. Samuel A. De Force and William V. McConnell, of Crockett, Texas. The object of this invention is to furnish an improved machine for cultivating cotton which shall be so constructed as to bar off, scrape, chop, and dirt the cotton upon both sides of a row at one passage.

Mr. William R. Iles, of Fairmount, Ill., has invented an improved check row planter, of that general form in which a cord or chain is provided at regular intervals with lugs, tappets, or knots, which cord is staked upon opposite sides of the field, and which knots or tappets, as the machine is drawn across the field, successively operate the dropping devices to cause the corn to be dropped in perfect check row. The improvements consist in the novel construction of the device upon which the cord or chain acts to impart the motion to the seed slides, and in the peculiar construction of guides from which the rope or chain passes out to the front and rear of the machine.

NEW SYSTEM OF DIGGING AND CURBING WELLS.

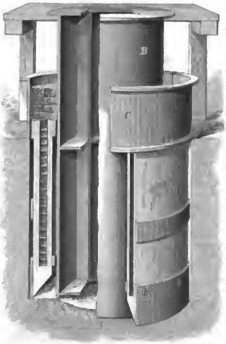
The annexed engraving represents a novel method and apparatus for digging and curbing wells, recently patented by Mr. Christopher C. Hackett, of Floyd, West Carroll Parish, La. The invention is intended to secure accuracy in the shape of the well and in the direction of digging; it permits of proceeding simultaneously with the two operations of digging and curbing, and it prevents the caving in of the well. In the engraving, which is partly broken away to show the internal construction, the sand box, A, which is shown as just entering the shaft, forms the foundation of the wall, and follows the shaft as it is dug by the workman. This box is made of wood, and is hollow from the top nearly to the bottom. Below the hollow portion the staves are chamfered off from the inside to give a narrow bearing edge. The staves are held together by iron hoops upon the outside, and wooden hoops on the inside, and the annular chamber formed between the staves is filled with masonry. A platform is erected over the well shaft at the proper height to enable the workman to lay the well curb or wall underneath.

An inside guide, B, consists of segments forming a cylinder, of a diameter just sufficient to allow it to fit inside the sand box. The wall is supported by an outside guide, C, a little larger than the sand box, which rests on the earth at the edges of the mouth of the shaft. For the sake of convenience in placing and removing, it is divided diametrically.

The invention is applied by sinking the sand box, A, into the shaft its full depth, then the platform is erected over it, and the sectional inside guide, B, is passed down in the sand box. The workman then proceeds with the digging, and as he deepens the shaft the sand box sinks, and the wall or curb is built on top of the sand box between the walls of the inside guide, B, and those of the outside guide, C.

The thickness of the curbing or wall equals the thickness of the walls of the sand box, and the inside and outside guides supply a sure guide for building it. As the shaft deepens, the sand box, and with it the finished curb built upon it, sinks.

In this way the digging and curbing are carried on at the same time. The chamfered lower part of the sand box permits the workman to reach with his tools to the edge of the box, so that he can dig evenly all around and underneath it, and thus let it descend evenly. Above the platform an ordinary derrick is erected, with a windlass, pulleys, etc., for lowering the sections of the inside guide, and hauling up the detritus. If, after the well is dug, the water should fall below the top of the sand box, and thereby expose it to decay, the brick filling or masonry contained in it will remain as the foundation of the well or curbing, and thus prevent it from caving in.



HACKETT'S IMPROVEMENT IN DIGGING AND CURBING WELLS.

The inventor informs us that wells made on this plan are free from surface water, and are shut out from contamination by the infiltration of sewage, as the walls may be made perfectly tight by the use of cement, and no water can enter that does not come from the fountain head. This is a very essential feature where wells are still in use in the larger towns and cities, and it is not less so in the country, where now, in a large proportion of cases, foul water from the cattle yards finds its way into the wells.

LIGHT LOCOMOTIVES.

Persons who are familiar only with the ponderous locomotives that are used on the great through freight and passenger lines would hardly recognize their kinship to the many varieties of light locomotives that are used for all kinds of special service. We present illustrations and descriptions of a few of these light locomotives, built by H. K. Porter & Co., of Pittsburg, Pa., whose shop, we are informed, is the only one in this country exclusively occupied by this kind of work.

MINE LOCOMOTIVES.

The adaptation of the light locomotive to use inside of mines involves modifications which change its outward appearance without specially affecting the working machinery. The smoke stack is shortened, the roomy wooden cab is replaced by a low iron canopy, the steam dome is reduced in height, and a special throttle valve used to secure dry steam; and the sand boxes and whistle are placed out of the way. Some of these mine locomotives never see the light of day; they are sometimes little more than four feet in height, so that a man can easily look down the smoke pipe while standing alongside of the track, and if he has tolerably long legs he can ride the locomotive sitting astride the water tank. In spite of their diminutive size these little turtle shaped machines are very powerful. One engine does the work of ten to thirty or more mules, at about the daily expense of operating two to four mules, while the cost of the engine is usually rather less than that of the animals it replaces. Its life is longer, and it consumes nothing while standing still during any suspension of mining, for it only needs a few cents' worth of white lead and tallow to keep it in good condition while standing in its stall; mules, on the other hand, do not have diminished appetites when not at work. Another important advantage of the locomotive over animal power is its ability to haul extra heavy loads and make more frequent trips whenever an increased output is desired, and this is done without any additional investment beyond a trifle more coal and water used. To increase the output by animal power involves an increase in their number, for flesh and blood have not the capacity possessed by iron and steam to endure overwork.

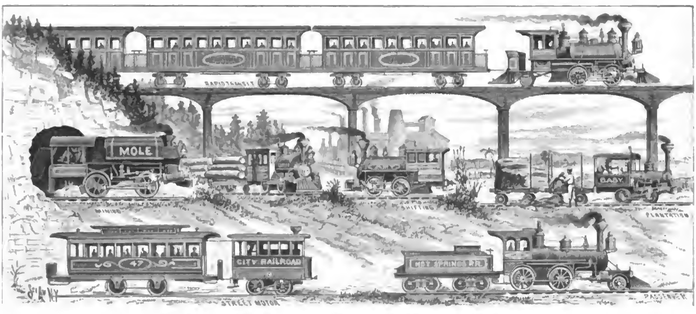
Mine locomotives are not only valuable in coal mining, but are also well suited to the mining of precious metals, where they effect such a saving as to bring into the market great quantities of low grade ores which are not rich enough to pay for hauling by animals.

The economy of locomotive over animal power applies of course to all kinds of surface tramways as well as to underground hauling.

LOGGING LOCOMOTIVES.

The quantity of lumber used annually in the United States is enormous, and one large item in the cost is the expense of hauling the logs to where they may be floated or carried by rail to the mills. This is now done to a great extent by light locomotives on cheaply built railroads. In the northern districts logs are also hauled on sleds over the snow. This is impracticable for long distances and is expensive in all cases, and is liable to interruption in mild or open winters, in which case the logs left in the woods till the next season are often destroyed by boring worms, fire, and decay. The locomotive is independent of the season of the year, and is capable of hauling immense quantities of logs and to run twenty-four hours a day when the price of lumber makes this desirable. The hauling is done so cheaply that "culled" or poorer grades of logs, which would otherwise be left to rot in the woods, can be profitably marketed, and a logging operator can make a handsome profit when selling at what are cost prices to others who haul by animal power. The size and style of the locomotive, and the weight of the rail used depend on the amount of business and the length of the haul. The whole outlay for a steam logging railroad is about fifty cents to one dollar for each thousand feet of lumber readily reached by it, or considerably less for large tracts. When the tract is all cut off, the railroad may be shifted to another tract at slight expense.

One of the most important logging railroads in Michigan is some thirteen miles long and uses four locomotives, each of eight tons weight. Several square miles are annually cut off to furnish it with freight, which runs up to about a half million tons each year. Like many of these roads it has no railroad connection, and the only communication



LIGHT LOCOMOTIVES BUILT BY H. K. PORTER & CO., PITTSBURG, PA.

with civilization is by a wagon road some fifteen miles long. Over this road, which for most of the distance is hardly more than a cart track of the roughest description, the rails and rolling stock were hauled. The locomotives were taken in pieces, with the exception of one, which was so urgently needed that, to save time it was fired up and run by its own steam, without any rails at all, over the dirt road to its destination. A force of men, equipped with levers to steer the engine round corners, went ahead, and wagons carrying water and fuel followed. The journey was made without accident and much to the amazement of the lumber choppers, who were not accustomed to see locomotives traveling through pine forests in search of a railroad.

Lake Tahoe, California, is a beautiful body of water surrounded by mountains. It is noted for its clearness and depth, and it is said that the bodies of those drowned in it never rise. It is now utilized for logging purposes, being reached by a chute one third of a mile long, down which the logs, weighing from five to ten tons each, slide in less than half a minute, followed by a track of smoke and flame. The report made when a log strikes the water is heard a mile away, and the spray is thrown into the air as high as a church steeple. These immense logs are all carried along the mountain sides to the top of the chute by a little logging locomotive whose weight is less than many of the logs it hauls.

At Dutch Flat, Cal., a novel and ingenious application of locomotive power is in use. The track of the logging railroad runs high up along the mountains, and a great part of the timber grows on the sides and bottoms of precipitous cañons. An inclined plane, 1,200 feet long, with a perpendicular descent of 600 feet, runs from the railroad down the mountain, and the locomotive is run on to a siding where friction rollers are set in the track. Resting on these rollers the locomotive driving wheels turn twenty miles an hour without advancing an inch, but the motion is communicated from the rollers by gear wheels to a drum on which is wound a steel wire rope. By this simple device a twelve-ton locomotive pulls up a load much heavier than itself. When enough logs have been hoisted to make a train load, the locomotive is run on to the main track again, and pursues the even tenor of its way just as if it had not been transformed into a stationary engine. The same attachment may be used to supply power to a sawmill or other machinery.

PLANTATION LOCOMOTIVES.

In tropical countries, where the soil is very soft and the sun's heat excessive, light locomotives have been introduced lately for carrying sugar cane from the fields to the crushing mills, hauling fuel and supplies, and doing other work as desired. For such roads the rails and cross ties are usually furnished by the manufacturer all put together ready to lay, so that the track is more or less of a portable character. Rails of about sixteen pounds weight per yard are used, and the track is not often kept in good order, especially in the rainy season, when it may be so covered with mud as to be invisible. Farm hands, coolies, Chinese, or negroes are likely to be pressed into service as engineers, and under such circumstances the simpler and stronger the machinery the better, while on the other hand the locomotive must be as light as possible. The manufacturers inform us that the plantation locomotive shown in the illustration meets the conflicting requirements of this service admirably. The cylinders of the smallest size are only five inches in diameter and ten inches in stroke, the driving wheels twenty-two inches diameter, and the entire weight, in running order, only about three tons. The water tanks are placed under the engineer's seats, and either coal or wood, or "bagasse" (the dry-pressed cane), may be used for fuel. Larger sizes, requiring heavier rails, are also built. Sometimes a pair of pony wheels support a water tank placed at the rear end, nd sometimes the tank is placed over the cylindrical parts of the boiler. These locomotives are used on the sugar plantations of the Southern States as well as in the West Indies. The gauge of track varies from two to three feet.

SHIFTING LOCOMOTIVES.

Nowadays almost every large establishment situated on a railroad, and having side tracks for receiving and shipping by car loads, owns its own shifting locomotive. Some of the larger iron and steel works operate as many as a dozen locomotives of this class. Compared with shifting cars by a gang of men with pinch bars or by teams of horses, or with depending on the railroad company for placing cars where they are wanted, the economy and convenience of owning a shifting engine is very marked. Where a narrow gauge track is also used for hauling coal, ore, lumber, or other supplies, a third rail is often laid on the wide gauge siding, and the narrow gauge engine does the shifting and work for both tracks. One remarkable feature of these shifting locomotives is their great power as compared with their small size. This is due to the fact that all their weight is placed on the driving wheels, and is used for traction. They have repeatedly hauled trains that larger engines of usual construction could not move. This, to an ordinary observer, seems impossible, but is readily understood by a mathematical comparison of the proportions between the size of the driving wheels, the useful weight, and the cylinder capacity.

SPECIAL SERVICE LOCOMOTIVES.

Light locomotives of the same general styles of those made for logging railroads, plantations, and for shifting are also put to a great variety of uses, as, for instance, hauling mud from dredging machines to fill up low and worthless lands; pushing white-hot ingots of Bessemer steel at rail mills; carrying the crude material of the well known superphosphates; for moving stone and earth at great engineering works, such as the Hoosac and Musconetcong Tunnels, the Rapids Improvements near Keokuk, and the government works at Mussel Shoals; for removing cinder at blast furnaces, and for miscellaneous hauling at coal and iron works, quarries, and other places.

We present, also, illustrations of light locomotives specially designed for rapid transit on surface or elevated roads, for street railroads, and for narrow gauge railroads.

For more detailed description of the performances of light locomotives, their weight, dimensions, and general construction, and other items of general interest connected with their use, the reader is referred to the illustrated catalogue of Messrs. H. K. Porter & Co., of Pittsburg, Pa.

THE HYENA DOG.

Just as the Aard wolf appears to form the link between the civets and the hyænas, being with some difficulty referred to either group of animals, so the hunting dog seems to be the connecting link between the dogs and the hyænas. Its position, however, in the scale of animated nature is so very obscure that it has been placed by some zoologists among the dogs and by others among the hyænas. As, however, the leading characteristic of its formation appears to tend rather toward the canine than the hyænine type, the hunting dog has been provisionally placed at the end of the dogs rather than at the end of the hyænas.

In its general aspect there is much of the hyænine character, and the creature has often been mistaken for a hyæna, and described under that name. There is, however, less of the hyænine type than is seen in the Aard wolf, for the peculiar ridge of hair that decorates the neck of the hyæna is absent in the hunting dog, and the hinder quarters are not marked by that strange sloping form which is so characteristic of the hyæna and the Aard wolf itself. The teeth are almost precisely like those of the dogs, with the exception of a slight difference in the false molars, and therefore are quite distinct from those of the hyænas. But the feet are only furnished with four toes instead of five, which is a characteristic of the hyænas, and not of the dogs. Several other remarkable points of structure are found in this curious animal, some of them tending to give it a position among the dogs, and others appearing to refer it to the hyænas.

The general color of the hunting dog is a reddish or yellowish brown, marked at wide intervals with large patches of black and white. The nose and muzzle are black, and the central line of the head is marked with a well defined black stripe, which reaches to the back of the head. The ears are extremely large, and are covered on both their faces with rather short black hairs. From their inside edge rises a large tuft of long white hair, which spreads over and nearly fills the cavity of the ear. The tail is covered with long bushy hair, which is for the greater part of a grayish-white hue, but is strongly tinged with black near its insertion. In nearly all specimens there is a whitish patch below each eye. These tints are somewhat variable in different individuals, but preserve the same general aspect in all.

There are many names by which this animal has been called; in the writings of some authors it is mentioned under the title of the painted hyæna, while by others it is termed the hyæon dog. The Dutch colonists of the Cape of Good Hope, where this creature is generally found, speak of it by the name of wilde hund, or wild dog; and it is also known under the names of simir and melbia.

Its title of hunting dog is earned by its habit of pursuing game by fair chase, and uniting in packs of considerable numbers for that purpose. As is the case with the generality of predaceous animals, it prefers the night for its season of attack, but will frequently undertake a chase in broad daylight. For the purpose of the chase it is well fitted, as it is gifted with long and agile limbs and with great endurance of fatigue.

A successful and practical sportsman, who has witnessed the performances of fox hounds and hunting dogs, is inclined to give the palm to the latter animals, for their almost in

HYENA DOG.—*Lycaon venaticus.*

variable success in the chase. He suggests that to the ample nostrils and the wide forehead of the hunting dog must be attributed much of the keen scent and the apt intelligence that renders these animals so successful in their united efforts. He also offers a further suggestion, that it appears as though freedom were a necessary adjunct to the hunting spirit, for we cannot train any animal to hunt with half the real zest which the same creature exhibits in its native or wild state.

When brought under human control, it is rather apt to retain its native ferocity, and to reject the companionship of mankind. Yet it has been known to enter into friendship with other animals, such as the hyæna and the lion, and was not more quarrelsome than is ordinarily the case among predaceous animals of different species. The experiment of its domestication has not as yet been fairly tried; and in all probability the creature will yield to the influence of man without any difficulty, whenever it may be subjected to the authority of a competent teacher.

The Long Island Scallop Fisheries.

In a detailed account of the scallop industry of New Suffolk, Long Island, prepared for the *Herald*, we find the following facts of general interest:

The favorite grounds for the fishing, or rather dredging, is in a line drawn from northwest to southeast across Peconic Bay from New Suffolk toward Southampton on the eastern shore. Here the scallops are always found. The dredging is done in waters from 3 or 4 feet in depth to 5 or 6 fathoms. The dredge is shaped like an old fashioned dirt-road scoop. The lower rim or scraping iron is probably 2½ feet long, an inch wide, and a good ¾ thick. To this is attached a piece of chain netting of 2 feet depth. Over this is the same length of cord netting, running from its attached end to the chains joined to a round bar of iron, which forms the upper part of this bag or pouch. A handle of iron, with an eye at the end, runs from where the upper and lower sides of the pouch are joined together. To the eye mentioned is attached the dragging rope. Thus equipped the vessels sail backward and forward over the beds, scooping in the shell fish as they lie huddled on the bottom. The scallop is a peculiar bivalve. Unlike the clam or the oyster, which seems incapable of progressive motion, the scallop is a rover.

When the tide is running fast and the water shallow it will rise from the bottom, with open shells, to the top of the water, squirt out the water contained between the shells, and by means of the impetus given and the force of the tide, will swim a yard or so at every spring. The motion is a laughable one, as the shells come together with a snap that can be heard some distance, and the motion is zigzag instead of direct. Some seasons the fish are much larger and finer than others. Thus this year they have been small. Last year they were twice the size. The catch is from twenty to a hundred bushels a day, according to the size of the boat and number of men engaged.

From November 1 till March is the fishing season. The catch varies; for the crop of scallops, like crops raised on land, changes with the season. Thus this year the catch has been a light one, and prices at the grounds have been as high as $1 for a gallon of meats, or, as the fishermen say, "eyes." The great crop, or bonanza year, was in 1877, when it was estimated that from the ports of Riverhead, Mattituck, New Suffolk, and Greenport the shipment to our city ran up to the large number of 40,000 gallons. The price, however, ran down as low as 50 cents per gallon, barely paying expenses.

Of the ports named New Suffolk is the chief, and has the largest number of individuals engaged in the trade. Fourteen vessels, in size from the cat rigged sailboat, of a couple of tons register, to the schooner rigged vessel of twenty, hail from New Suffolk. The crews run from a man and a boy on the smaller to a half dozen able-bodied men on the larger boats. The work is of the hardest and is of the coldest sort.

The number of those employed at New Suffolk—scallop headquarters—is about 150 of all ages, from men and women of sixty all the way down to boys and girls of ten and twelve. In the year 1877 the largest shipment ever made was forwarded; this was close to 40,000 gallons of eyes, or representing a catch of 80,000 bushels of scallops. Last year the catch was but half that, while this season it will not run so heavy as last. The old hands say that the scallop lives but three years; that the spawned fish is two years reaching maturity; the third year it is full grown and spawns, and then dies.

This multitude of scallops attracts to the waters of Peconic Bay thousands of water fowl. Black duck, geese, loons, and the common non-edible duck, such as coots, old squaws, and whistlers, are in immense numbers, while the gulls fairly whiten the sand bars when the receding tide leaves the sands bare.

The Croton Bug as a Library Pest.

At a meeting of the American Library Association, in Boston, Mr. Weston Flint made a brief statement of the injury done by the croton bug upon the covers of books. He stated that he had found these insects the worst pests that libraries have to suffer from in this latitude, and that he had noticed that they were often carried about in packages of books from the bindery. They attack the starch or sizing in the cloth covers, and often destroy the gold literally to secure the little albumen used in that work. After several trials, Mr. Flint found that the most effective remedy against these pests was a plentiful supply of a powder in which *Pyrethrum* was the principal ingredient. With a small bellows, this powder was thrown among the books on the shelves and allowed to remain. This operation performed once a year seems to be sufficient to keep them out. Mr. Flint having written to Prof. C. V. Riley in regard to the habits of the insect, that gentleman replies as follows: "The name of croton bug is *Blatta Germanica*, an insect originally introduced into this country from Europe, just as its larger conquerer, *B. Orientalis*, was. I have long considered it the worst pest we have in the libraries, and was not a little surprised that Dr. Hogen made no mention of it in his paper read before the American Library Association. The larger species (*Orientalis*) also helps in the work, as shown by what Dr. Hogen quotes from Mr. J. A. Lintner; but the croton bug is so much worse than any of the others, that all combined are not as mischievous. It shows a decided preference for books bound in green cloth, and seems to me to gnaw into and loosen the fibers of the fabric solely for the purpose of getting at the sizing or enameling. The worst of it is that this pest attacks books in the best kept libraries, and is indifferent whether the works be old and musty or just from the bindery; and the newly hatched roaches get through such a small crevice, that it is very difficult to get a bookcase tight enough to exclude them. I have been able to discover no remedy beyond diligence and the use of a little *Pyrethrum* occasionally sprinkled about on the shelves; but I make it a point nowadays to have all books bound in leather, such not being touched by the *Blattas*. This, and the other fact that it confines its injuries to the outside of the book and never affects the inside or more essential part thereof, form the only two redeeming traits in the little rascal's habits." Mr. Flint (who is librarian of the United States Patent Office) adds that one care should always be taken; and that is to open packages coming from the bindery before they are admitted to a library. This will keep them out. If they do get among the books, use the *Pyrethrum* powder immediately.

The Uses of the Potato.

In France the farina is largely used for culinary purposes. The famous gravies, sauces, and soups of France are largely indebted for their excellence to that source, and the bread and pastry equally so, while a great deal of the so-called cognac, imported into England from France, is distilled from the potato. Throughout Germany the same uses are common. In Poland the manufacture of spirits from the potato is a most extensive trade. "Stettin brandy," well known in commerce, is largely imported into England, and is sent from thence to many of our foreign possessions as the produce of the grape, and is placed on many a table of England as the same; while the fair ladies of our country perfume themselves with the spirit of potato under the designation of *eau de Cologne*. But there are other uses which this esculent is turned to abroad. After extracting the farina, the pulp is manufactured into ornamental articles, such as picture frames, snuff boxes, and several descriptions of toys, and the water that runs from it in the process of manufacture is a most valuable scourer.

For perfectly cleansing woolens, and such like articles, it is the housewife's panacea; and if the washerwoman happens to have chilblains she becomes cured by the operation.

Few persons are aware of the great demand for potato flour, and of the almost unlimited extent of the market that can be found for this product, which is simply the dry evaporated pulp of the ordinary potato—the whiter and more free from black specks the better. It is used for sizing and other manufacturing purposes, and by precipitation and with the aid of acid is turned into starch. In Europe it meets with a large and increasing demand in its primitive state, as potato flour, and in Lancashire alone 20,000 tons are sold annually, and as many more would be taken if put on the market. When calcined it is used largely for silk dressing and other purposes. At present the quotation for potato flour in Liverpool is nearly double that of wheat flour. Consignments to Liverpool are solicited by the brokers there, who promise to take all that can be furnished.

During the Franco-German war the French Government purchased all the farina it could secure and mixed it with wheaten flour in "potato cakes" for the army. Farina at that time rose to £40 a ton, and even the supply fell far short of the demand. Since then an increased amount of farina has been regularly consumed in France, and farina mills have correspondingly multiplied in that country. The manufacture of potato flour is so simple, and the results so methodical, that it requires very little experience to reach a satisfactory issue. The potatoes are first steeped in water from six to twelve hours to soften the dirt and other matter adhering, after which they are thoroughly washed by mechanical means with the aid of either steam or water power. They are then reduced to a pulp by a rasping or grinding process in a properly constructed mill. A small stream of water is caused to flow on the upper surface of the rasp or grinder, to keep it clean of accumulation of pulp. From the grinder the pulp falls into a washing machine, through which the farina is forced by revolving brushes, the coarser pulp being thrown out at lateral openings. The granules of farina pass into a trough, and are conducted to vats, where the farina is permitted to deposit. After the proper number of filtrations, and depositions have occurred, until the last deposit, which is pure white farina, the latter becomes of sufficient consistency to cut into lumps, and place, either unsupported or in conical wire cases, to dry. The drying process can be accomplished in a building supplied with shelves, and capable of being heated from 60°, at which the farina begins to dry, up to 212°, which is as high a temperature as it will require. The heating apparatus may be such as is most convenient. In Europe the farina is packed in 200 to 212 pound fine sacks, but flour barrels are said to be preferable, as the wood protects it from damage, and allows it to be transported safely to the most distant regions.—*The Journal of Applied Science.*

Animal Tar.

Not many years ago the substance known as coal tar was regarded by chemists as well as by laymen in the light of an uninviting and almost hopelessly complex mixture. To-day, as is well known, it is the source of a large group of highly interesting bodies, and forms the basis of many important industries, some of which are still in their infancy. Certain recent developments in connection with animal tar seem to indicate that there is a future in store for this substance as interesting and as important as the present of coal tar. It is obtained in largest quantity as a secondary product in factories in which boneblack is made by dry distillation of bones and other animal material. By fractional distillation the tar can be divided into several distinct portions, among which are the bases known as pyridine, C_5H_5N, and picoline, C_6H_7N, which are the first two members of a homologous series. Now, through the researches of Dewar, Ramsay, Weidel, Hofmann, and others, it has been shown that these bases are intimately connected with such alkaloids as quinine, cinchonine, cinchonidine, berberine, piperine, and nicotine. All of these alkaloids when oxidized yield acids which are simple derivatives of pyridine or some other member of the series. The chemistry of the alkaloids is then, in all probability, to be discovered through a careful study of the bases of the pyridine series, and this probability has of late led a number of workers to turn their attention to these bases. It can fairly be prophesied that at no distant time our knowledge of the alkaloids will be materially increased through the aid of investigations now in progress.—*Amer. Chem. Journal.*

Glucose for Confectionery.

The *Confectioner's Journal*, in regard to glucose and its enormous product in this country, says: At first it was affirmed that the sugar made from corn was injurious. The learned chemists decided that it was perfectly harmless. The consequence is that vast quantities are now made and sold. Besides a great establishment in New York, there is another in Buffalo, another in Chicago, and several minor establishments in other cities. One of these great establishments used five million bushels of corn in the year 1878.

Confectioners are using great quantities of glucose sugar, because from its uncrystallizable quality it tends greatly to keep certain classes of goods soft for a greater length of time, and retards granulation in other kinds, and because it saves greatly in the cost of all articles with which it is combined.

It was proved before the Congressional Investigating Committees that vast quantities of glucose or corn-starch sugar were sold to sugar refiners; also, that it is sold in great quantities to confectioners. Glucose is now largely used in mixing with California honey, one gallon of glucose to one of honey. It is also used largely in the Eastern States in the manufacture of all sweet wines, lager beer, and all liquors requiring sirups. In fact, corn sugar is now used for all the various purposes for which any sugar is used, except for first-class confectionery. Glucose is also shipped in large quantities to Europe, where it is in great demand and in increasing quantities.

The Steamer Louisiana.

The new steamer Louisiana, of the Cromwell Line, is provided with engines said to possess the largest stroke of any direct-acting engines in the world; they are fitted with balance poppet valves, adjustable cut-offs on both high and low pressure cylinders. The high pressure cylinders having direct connection with one end of the working beam, which is located athwartships, the low pressure cylinder having connection with the opposite end. The engines work well. With eighty pounds pressure of steam they work up to sixty revolutions a minute. The propeller is 17 feet in diameter, and has 27 feet pitch. There are eight patent boilers, of Baird's make, and it is anticipated that the vessel will be a very fast one, as on her trial trip she averaged ten knots an hour with only four boilers at work. The steamer has two iron masts, and on each a "leg of mutton sail" is bent; she carries a jib and foresail and two skysails. The hull is divided by seven watertight bulkheads, which extend to the main deck, and four partial bulkheads. The main and lower decks are entirely of iron. Above is the hurricane or spar deck, on which are situated the wheelhouse filled with steam steering apparatus and the cabins of the captain and other officers. On the main deck is a house which extends from the forehatch to the stern, in which is situated the saloon.

The Louisiana was built by Roach & Son, of plates of extraordinary strength and thickness, the machinery being constructed by C. H. Delamater & Co., of this city. She will carry 100 first and second class passengers, and it is expected that 9,000 bales of cotton can easily be stowed in her hold.

The Hayden Trial.

Further expert testimony has recently been put in by the defense at the Hayden trial, and has furnished statements of considerable interest. In our previous comments on this trial, we mentioned that the three principal points upon which the testimony bore were: The symptoms and signs which may be produced by the presence of a small ovarian cyst; the tests for blood; and the possibility of distinguishing different samples of arsenic, by the proportion of crystals to amorphous particles seen under the microscope.

The victim, Mary Stannard, was found to have a small ovarian cyst, about three fourths of an inch in diameter. It was claimed by the prosecution that this had given rise to symptoms of pregnancy, and that she had been killed by the defendant in order to avoid the public exposure which her supposed pregnancy would cause.

It will at once appear that the idea of a cyst, so small in size, producing symptoms of pregnancy, can only be characterized as absurd. It cannot perhaps, be absolutely denied that such a tumor may produce some symptoms, since few things can be absolutely denied in medicine. But that such remote possibility of some ovarian irritation should be taken as the basis of a theory of prosecution, shows alike a poverty of theories and of medical knowledge. Such tumors are not very unfrequently found at the post-mortem table, no evidence of their presence having previously been given. They are even found before the age of puberty, and may sometimes remain stationary and undeveloped. The ingenuity of an imaginative legal mind may make it appear probable to the jury, that because the young woman had a small cyst, therefore she had the symptoms of pregnancy; but we do not see how they secured medical experts to help them along. She might have been hysterical, she might have been an excellent case for a gynecologist and a medicated pessary; but she could only by the rarest coincidence have furnished the signs of pregnancy. To this effect the experts for the defense testified.

The counter testimony, in regard to the detection of various samples of arsenic, was not very extended. It was asserted that, owing to peculiarities in the grinding of arsenic, the same manufactory might send out lots in which the proportion of crystals would vary. On the whole it seems likely that, as we have stated before, the determination of the source of arsenic by its microscopical appearance can rarely be a certain one. The value of the discovery, therefore, of a varying proportion of crystals in different lots, must, from a medico-legal point, be quite limited.

The question of the tests for blood was testified upon at considerable length. The experts secured for the defense were unanimously positive that human blood could only be distinguished from that of certain other mammals under rare and very favorable conditions, if at all. This was in direct contradiction to the evidence for the prosecution. Dr. Woodward testified that the size of human blood corpuscles in different persons was as variable as that of the individual; and that the size also varied greatly even in the same animal. The range was said to be greater in disease and in the young. This variability applied not only to man, but the lower mammals. It would take, said the witness, forty-two years to find the true average size of the corpuscles of any animal. Alluding to the history of such measurements, the great variance of opinions during different periods was shown. Thus Gulliver, in 1848, made the average size 1-3200 of an inch. In 1864 the average size was found to be 1-3000 to 1-3100 of an inch. The most recent authoritative measurements made the average diameter 1-3630 of an inch. Dr. Woodward took, in general, a very pessimistic view of micrometry. His statements are, however, to some extent misleading. When it was first undertaken to measure blood corpuscles there was no accurate and definite standard for the micrometers; nor is it until recently that this lack of a definite standard has been overcome.

The variation in measurements, therefore, by different observers, may indicate variation in micrometers rather than in the corpuscles. An examination of the different sets of measurements will show a substantial agreement as to the relative size of human corpuscles compared with that of other animals. The statements concerning the great variability in the size of the blood corpuscle are not in accordance with those of the majority of microscopists. Physiologists state that the red blood corpuscle varies less in size than other anatomical elements. Kölliker asserts that ninety-five per cent are of the same size. It is generally agreed that man's red blood corpuscles are larger than those of any of the ordinary domestic animals from which distinction has generally to be made.

In the present case the defendant testified that he had killed chickens with the knife in whose notch corpuscles were found. Since it would be comparatively easy to distinguish the oval corpuscles of the fowl, we were inclined to lay some weight on the testimony of the experts for the prosecution. The impression given by Dr. Woodward as to the exceeding vagueness and inaccuracy of microscopic measurements was unjustifiably strong.

The possibility of distinguishing, under proper conditions, the human blood from that of other animals, cannot be denied. The possibility of being able to do it, however, in any particular case with sufficient certainty to swear away a life, is another thing entirely, and the one to which we do not believe. In the present case, although the scalpel discovered an ovarian tumor, and the microscope arsenical crystals, and possibly human blood, there was nothing established by the expert testimony strong enough to warrant a verdict of guilty.—*Medical Record.*

How to Keep Teeth Clean and Healthful.

As I am not aware of anything practically new in the way of dentifrices, I can only allude to them as auxiliaries or assistants in promoting cleanliness, and in neutralizing the abnormal acidity so commonly present in the oral cavity. No one has yet discovered the magic prophylactic, notwithstanding the absurd claims of the venders of various nostrums, such as "Sozodont." Of this article I will testify to what is also well known by most dentists, namely, that it destroys the color of the teeth, turning them to a decidedly dark yellow.

There is, of course, quite a general use of tooth brushes by the people, but not uncommonly an abuse of them for want of proper instruction. It is getting to be better understood by both dentists and patients now than formerly that a crosswise brushing is not wise, but that the upper teeth should be brushed downward, and the lower teeth upward. It is a common mistake not to brush thoroughly the buccal and posterior surfaces of the third molars, and the lingual surfaces of the lower front teeth. I am sure that nothing like an adequate amount of care is given to this preventive service. It cannot be too strongly impressed on the minds of the guardians of children that they should see that the practice of brushing the teeth thoroughly is begun as early as possible, so that it shall become a habit to be continued through life.

Concerning the forms of brushes, I will say that straight brushes are utterly impracticable on the surfaces to which I have referred as the ones most neglected. Curved brushes with a tuft end, bud-shaped or convex, are the best. There are several favored forms that are quite efficient in the line I have spoken of. One of these, named the "Windsor," I have faithfully tried for twenty months past, and introduced it very generally in my practice, and I feel that it meets the indications better than any other within my knowledge. The faithful use of floss silk between the teeth ought to be earnestly recommended; also the *quill* toothpick. The wood toothpicks so generally furnished at public eating places are a source of much evil to the soft tissues between the teeth. All kinds of metallic toothpicks are objectionable, though I am aware that it is the practice of some dentists to commend them to their patients.

The value of a decided polished surface of the tooth becomes very apparent to those who have had the operation performed; the facility with which such teeth can be kept clean is evident; and although this condition may have been secured at considerable expense, yet it is an investment that will pay a good rate of interest. I do not think many dentists have much idea of the beautiful polish that a human tooth will take. Many teeth are capable of a great improvement in this direction which are now a decided detriment to what might otherwise be a pleasing face. We know that the general idea among the people is, that interfering with the surfaces of the teeth destroys the enamel, but we also know that this is a popular error.—*G. A. Mills, in Dental Cosmos.*

Infectious Diseases among Live Stock.

Arguing in favor of general legislation with regard to infectious diseases among horses, cattle, sheep, and swine, Mr. Le Fevre said in Congress recently: We have today at least 100,000,000 head of the four principal classes of farm stock named above. If we average these at the low sum of $3 per head we have a money value of $300,000,000. These animals are all subject to deadly contagious and infectious diseases, and unless some general protective law can be passed, the increase of loss to the farming community must increase at an alarming ratio with each recurring year. An eminent veterinarian, in summing up the losses occasioned by the ravages of pleuro-pneumonia among cattle in Europe, says that England imported lung fever of cattle in 1842, just one year before it was brought to the United States, where it has continued up to the present time. Up to 1869 it is estimated that Great Britain had lost, almost exclusively from this disease, 5,549,780 head of cattle, worth £83,616,854, or, say, $400,000,000. For the succeeding nine years, up to 1878, the losses have been equally as heavy, making a total loss of perhaps $500,000,000 in deaths alone, without counting the contingent expenses of deteriorated health, loss of markets, progeny, crops, disinfection, quarantine, etc. And yet England has a contagious disease (animals) act. What might have been the losses from this one isolated disease had it not been surrounded with all the safeguards of a law drawn with the greatest care and carried out with the strictest fidelity?

About twenty-five years ago a disease made its appearance among hogs in some of the great hog-growing States of the West. It attracted but little attention at first, but as it continued to spread from one State to another, and seemed to become more fatal with every recurring year, farmers and stock-growers, and occasionally a physician and surgeon, would devote a little attention to a cursory investigation of the malady, but no definite results were obtained until very recently—not until congress made an appropriation to commence and carry forward an investigation which should result in revealing the true nature and cause of this disease. The investigation has not yet been completed, but the infectious and contagious character of swine plague has been determined beyond question. For several years past the losses from this disease have been estimated at from $20,000,000 to $25,000,000 per annum. The disease has prevailed in this country for near a quarter of a century, and if we place the annual losses during the past decade at $15,000,000 per annum, we have a total loss, sustained principally by the farmers of the country, of $150,000,000. For the other fifteen years of the comparative infancy of the disease the losses no doubt amounted to as much more, making the total loss from this one disease of $300,000,000.

New Coloring Matters.

The new acid green, we learn, can be used for wool by dyeing with oxalic acid in the dye bath. On cotton it is dyed by mordanting first with sumac over night, then passing through tartar emetic, and dyeing in a tepid bath with the necessary amount of coloring matter. On calico it is printed with tannic acid or sumac extract, like methyl green; it is then steamed and, we understand, passed through tartar emetic. The acid green has the advantage that it does not run in steaming if used in connection with picric acid, a fact of great importance in printing; and furthermore, it resists the action of the heat without losing its shade. To print on wool, take 2½ gallons boiling water for 1 lb. green; filter and add 2½ gallons gum water and 3 lb. glycerine.

The Austrian firm, Przybram & Co., patented some time ago the production of a sulpho derivative of alizarine and purpurine, under the name of *alizarin carmine*, which they have now introduced into the market. The new coloring matter is used for dyeing wool, and is recommended as a substitute for madder in all its applications for wool dyeing. It is said to give nicer and purer shades. The alizarin carmine dyes wool of a red color when the latter is mordanted with tin crystals or alum. The sulpho-acids form salts with different bases. The alum salt can be used direct for dyeing wool; however, it is better to use the soda salt on previously mordanted wool by adding tartar to the bath. Different shades are obtained with different mordants.

We see in a foreign contemporary that the firm of Guinon, Joc. & Picard, in Lyon, have lately brought out a product under the name of hematine (*hæmateine*) a derivative of logwood. Hemateine ($C_{16}H_{12}O_6$) is formed from the chromogen of logwood, or hæmatoxyline ($C_{16}H_{14}O_6+3H_2O$) by treating it with ammonia. By this reaction hemateine-ammonia is formed, which gives hemateine either by evaporation in vacuo, or by boiling with acetic acid. Hemateine forms in this case a brownish red, and almost black precipitate, which assumes when dry a greenish metallic appearance like that of some of the anilin colors. When sharply ground and passed through a sieve it takes a redder coloration. It is soluble in water, alcohol, and ether. Hæmatoxyline is with hæmateine the coloring substance of a solution of logwood, which contains as well all the soluble substance of the dyewood. Hæmatoxyline gives with ammonia, hæmateia; the latter is also formed by sprinkling logwood with urin and by fermentation. The product has already been known for a considerable time; its cost, however, was so high that it precluded its application in dyeing, but the above firm have discovered a process by means of which the hæmateine is obtained much more cheaply than hitherto, and the product has already found its way into the dye houses of France, Switzerland, and Austria to such an extent that 2,000 kilos are daily produced in the works of Messrs. Guion, Joc. & Picard, and they are making alterations in order to more than double their output. The brownish black product is completely soluble in water like logwood; it dyes blue blacks, and does not rub off; 15 kilos hæmateine are said to be equal to 100 kilos best logwood, over which it is said to possess great advantages, as well as over logwood extracts.

CAULINE.—Messrs. Savigny & Collineaux have exposed, in an Exhibition of Science as applied to Industry in Paris, samples of

Cauline (the dye from cabbage) in powder, for solution in the dye bath, and as violet, lilacs, blue and green lakes, and as cauline black for leather dyeing. The two coloring matters, *alneine* and *ericine*, we alluded to in our October issue, have also been exhibited in powder, solution, and in paste; the latter also as dry lakes for calico printers and paper stainers.

The *alneine* can be employed instead of cachou in all its applications. On silk, wool, cotton, and jute it is said to give brown, salmon, and mouse gray shades, which are especially beautiful on jute; the shades are of great brightness and solidity, resisting chlorine and any amount of washing.

Cauline, which is extracted from red cabbage, is prepared dry or in sirupy extracts. On wool grayish colors are obtained, varying from silver grays to dark slate. Grayish and gray lilacs, as well as moss greens, can be obtained by cauline without the aid of any other dyestuff. Every metallic salt gives a different but constant shade with cauline, so that by using different mordants several shades can be obtained by dyeing in the same bath, and this latter can be kept and used for a considerable time. Wool dyed with cauline has great affinity for indigo, and very dark blues can be obtained by first dyeing with it, and then adding carmine of indigo to the bath.

On cotton the mordants used for wool give exactly the same shades when used with cauline, a fact of great importance in dyeing mixed goods. Used alone, it gives on cotton a violet and a peculiar blue shade, called cauline blue. For furniture articles, those of jute especially, it is reported that the three coloring matters we have described will be found of very great advantage either for dyeing or printing.

Further, from cauline a black extract can be produced, which dyes leather blue black. Besides these coloring matters, Messrs. Savigny & Collineaux exhibited at the same time a great variety of tasteful patterns dyed with their new products.—*Textile Manufacturer.*

Precautions against Photographic Forgeries.

Recently a number of London banks have printed in color on their checks their names in microscopic characters, repeated over and over so as to form a sort of pattern. The object of this microscopic printing is twofold. The erasing of a word or figure upon a surface of small print of this kind cannot be done without erasing some of the tiny words as well, and as these obviously cannot be restored, there is no way of covering up such erasure; in the second place the printing in color of such tiny letters is deemed sufficient to baffle any attempt to copy a check by means of photography. No doubt the bank authorities are right in their conjecture that it would be impossible to secure a copy of one of their checks before the camera, printed as the document now is; but for all that, the *Photographic News* deliberately expresses the opinion that a check of this kind is not nearly so safe as the finely executed checks in plain black and white of the Bank of England. Proof of this assertion is found in the recent successful use of photography in France in imitating colored checks. Even the blue notes of the Bank of France have not escaped these *chevaliers de l'industrie;* and it is but a year or two ago that the French police were enabled to make a seizure

Just after the Franco German war, when bank notes were exceedingly prolific with the French, there were large numbers of the spurious blue notes in circulation; and on the principle of setting a thief to catch a thief, the Direction of the Bank of France at once invoked the aid of photography to detect photographic forgeries. M. Gobert, a well known member of the French Photographic Society, and an accomplished photographic chemist, was retained by the Bank of France as adviser, and it is in a great measure due to him that abatement of photographic forgeries in France is due. Many years ago Mr. Spiller was called in as scientific referee in the matter of color printing upon checks, and gave much excellent advice upon this subject; but, unfortunately, English banks do not keep pace with the times, and what was impossible twenty years ago, is perfectly feasible at the present moment.

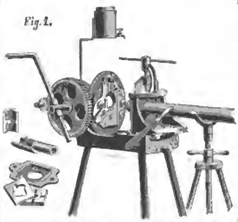
The German authorities used to consider that they had altogether defied imitation by having recourse to very fine printing at the back of their bank notes—similar to that on the checks of the Check Bank, London and Westminster, London and County, etc.—this fine printing, which was in black, setting forth the severe penalties which would be visited upon those who endeavored to forge such documents. This fine print, rather than acting as a barrier, resolved itself rather into a premium for copying by photography. The bank note was put under a microscope or magnifier, and the tiny printing thus enlarged, it could then be imitated by an engraver, and the photographer had simply to photograph the copy in order to produce the small printing. And so, the *News* is inclined to believe, the microscopic printing in color, rather than acting as a safeguard against the production of spurious checks, will render the matter somewhat more easy. The color—whether it is applied as a simple tint, or in the form of microscopic words—serves the purpose in a forgery of covering up defects in the engraving of the check. Rather, therefore, than adding to the difficulty of copying, it rather lightens it, since the work not being in pure black and white need not be so faultlessly executed. This is why the blue applied to the Bank of France was no protection.

Photographers, nowadays, know a good deal about the sensitiveness of various collodion films for different colors, and are also well versed in what may be done by under-exposure and over-intensifying, and *vice versa*, and there are few tints or designs that they cannot copy one way or another; and by having recourse to combination printing, a skilled operator will overcome the most stubborn opportunities. But there would be no need, of course, in order to imitate a modern check to copy the minute blue or pink printing upon them. This would be produced of large size; a reduced negative, executed with the type of proper dimensions, and impressed upon a colloid film, would be capable of yielding any number of impressions and in any color; while as to fineness of the type and freedom from blurring, the result would simply be more perfect than the majority of checks with which the public deal. Any one who has seen the fine details of a map reproduced upon a colloid film, the delicate shading and minute lines, will readily believe this, while we may point out that scarcely less perfect work is produced nowadays by a phototype process. The finely executed drawings we see upon the *Graphic Programme* and other theatrical publications, which are as delicate as anything done by engraving, are all prepared by the aid of photography, the original sketches, in the first instance, being produced many inches high. The lines are fine and black in the originals, and in the course of reduction become, of course, exceedingly delicate; thus it is that the drawings appear so refined beside an ordinary woodcut. These facts are recited to show how the graphic arts have improved of late by the aid of photography, and to point out that what might have been impossible some years ago is perfectly possible at the present day: and to this fact the bank authorities should give attention. Certainly, microscopic printing in colors cannot be relied upon at the present moment as a safeguard against the forging of checks; for a skilled hand would have more difficulty in counterfeiting the black and white document issued by the Bank of England than one in which a combination of colors is to be found.

A LABOR-SAVING TOOL.

The annexed engraving represents a very effective and simple pipe cutting and threading tool manufactured by the Chase Machine Company, New York city. This invention enables the workman to perform with ease one of the most tedious and laborious operations in mechanics, and it does its work expeditiously and perfectly. It is capable of cutting regular chips in the same manner as a lathe, leaving the work smooth and perfect. It will form a thread on all sizes of pipe from ¼ inch to 2 inches inclusive. To steam fitters, gas fitters, and machinists it will prove of great value, and car shops, steamers, sugar refineries, distilleries, should be furnished with these machines. Wherever it is required to thread pipes or bolts, or to tap nuts, this machine will be found efficient and satisfactory. The machine is capable of making nipples, and is provided with an automatic cut off. In its construction it is very strong and well adapted to the work for which it is intended. All the gears are cut and it is well finished in every part. It may be

Fig. 1.



CHASE'S PIPE CUTTING AND THREADING MACHINE.

worked by hand or by any convenient power, and it may be readily adapted to different kinds of work. It will operate equally well on wrought iron gas and steam pipes, boiler tubes, oil well tubes, brass and copper tubes, rods, bolts, etc. For further particulars, address The Chase Machine Company, No. 120 Front St., New York city.

Torpedo Investigations.

Brevet Brigadier General H. L. Abbot read a paper on "The School of Submarine Mining at Willett's Point" at the recent meeting of the United States Military Service Institution on Governor's Island. The paper contained the following information of general interest:

The first subject of study was to secure the best explosives for submarine warfare, and types of all explosives known to science were used with the result of finding the best for the service to be dynamite, consisting of 75 per cent of glycerine and 25 per cent of Keiselguhr. The element of time proved to be one of extraordinary importance with explosive compounds. Nitroglycerine under water develops but about eight tenths the intensity of No. 1 dynamite. The interposition of a wooden case between the charge and the water was found to greatly reduce the kinematic energy available. In order to discover the laws of transmission of a shock horizontally through water a wrought iron frame was used, and the charge secured at the central part, and gauges placed symmetrically with respect to a horizontal plane passing through it were secured at angles between the transverse frames. The results proved that the same formula can be used for all modern explosives by substituting the right numerical value for one constant. By this the relative value of explosive compounds can be fixed and the intensity of action computed. To learn completely the destructive range for subaqueous explosions, it was necessary to learn the intensity of action needful to destroy a first class ship of war. For this purpose an iron target twenty feet square was used to represent the bottom of a vessel made on the double cellular principle; and a numerical value for the intensity of action needed was found. From English tests, by aid of the previously mentioned formula, a second value of this element was reached, and some trials on a very strong wooden raft gave a third value. The three were so accordant that the value adopted by the Board of Engineers is satisfactory, and the size and range of the charge have been accordingly fixed.

The three essential conditions of a torpedo are endurance in sea water, power to resist shocks of explosions in the vicinity, and strength to resist the blows of friendly vessels in passing. Experiments to secure these objects have been carried on for six years, and a torpedo has been adopted finally which is believed to be superior to any abroad. Ground torpedoes are cast iron spheres resting on the bottom on their truncated base. Buoyant torpedoes are spheres of steel of a size suited to the strength of the current. For firing mines the active agent is electricity. The subject of the fuse has been exhaustively studied and new methods of research undertaken. Over eighty patterns of foreign and domestic varieties have been compared and are now in the museum at Willett's Point. The one finally adopted retains its action after years in a torpedo and is absolutely certain.

For the operation of mines a very superior system has been adopted and is kept secret. It allows the safe passage of friendly vessels, and causes explosions when struck by the enemy; or any one can be fired, every part can be tested, and an injury determined. In important harbors the electric light will be used in the system of defense. The form of lens adopted throws a concentrated light to any desired spot, but its use is impaired when the air is rendered opaque by moisture or smoke, as the particles in the air are brightly illuminated and form a screen to hide the object. Experiments with fish torpedoes have also been made, and one recently tried showed excellent results. The control of the fish was perfect, as it could be stopped, started, or turned in any direction.

The New System of Signaling at Sea.

The following system of ocean and river signaling has been agreed to by the governments of Great Britain, France, Germany, Russia, Italy, Spain, Portugal, Belgium, Denmark, Sweden, Netherlands, Austro-Hungary, Greece, Chili, and the United States of America. Besides the usual colored lights, a steamer discerning another steamer or sailing vessel in sight has to sound with the steam whistle or fog horn a short blast, which will mean "I am directing my course to starboard;" two short blasts will signify "I am directing my course to port," and three short blasts, "I am going full speed astern." In fog, mist, or falling snow the signals are to be repeated every two minutes, a prolonged blast indicating that the vessel is under way; an ordinary blast, that the vessel from which it proceeds is on the starboard tack; two blasts in succession, "I am on the port tack;" and three blasts in succession, the wind abaft the beam. A vessel in fog, not under way, has to ring the bell every two minutes. Concurrent with the foregoing are ocean signals. The Thames Conservancy are issuing rules of road, which are to take effect on British and foreign ships entering the River Thames. Where steamers are proceeding one up and one down the river, involving a risk of collision, they are to pass port side to port side. If there be no risk of collision they will both keep their course and pass either starboard side to starboard side or port side to port side. In rounding a point, like that where the Princess Alice collision occurred, the steamer going against the tide is to wait under the point until the vessel going with the tide has passed clear. Where a steamer and a sailing vessel are proceeding in a direction likely to involve a collision, the steamer has to slacken speed to keep out of the way of the sailing vessel and let the latter pursue her course. If the steamer cannot possibly or safely get out of the way she is to blow four blasts and slacken speed, and the sailing vessel is to keep out of the steamer's way.

Influence of Plants on the Products of the Dairy.

The Agricultural Museum, of Berlin, lately exhibited at the Dairy Exhibition a collection of plants which may influence the different products of the dairy. The catalogue gave the following list:

1. Plants which coagulate milk: the milky juice of the fruit of *Aspidosperma quebracho*, Lor., used in the Argentine Republic; the milky juice of the unripe fruit of *Carica papaya*, L., Papaw tree; *Cirsium arvense*, Lam., Canada thistle; *Cynara cardunculus*, L., Chardoon; *Ficus carica*, L., Fig; *Oxalis acetosella*, L., Wood sorrel; *Piper nigrum*, L., Black Pepper; *Quercus infectoria*, Oliv., Gall Oak; *Rumex patientia*, L., Garden Patience.

2. Plants which prevent the coagulation of milk: *Cochlearia armoracia*, L., Horseradish; *Pinguicula vulgaris*, L., Common Butterwort; *Sanicula Europæa*, L., Wood Sanicle.

3. Plants which are used to color butter and cheese: *Bixa orellana*, L., Annatto; *Calendula officinalis*, L., Marigold; *Carthamus tinctorius*, L., Safflower; *Crocus sativus*, L., Saffron; *Curcuma longa*, L., Turmeric; *Crozophora tinctoria*, Ad. Juss., Turnsol; *Daucus carota*, L., Carrot; *Morus tinctoria*, L., Fustic. [Also *Galium verum*, L., Cheese-renning Bedstraw, or Yellow Bedstraw.

4. Plants which are used to flavor cheese: *Melilotus cærulea*, L., Blue Melilot; *Penicillium glaucum*, Lk., Blue Penicillium.

5. Plants used to prevent rancidity in butter: *Rumex Abyssinicus*, Hochst., Abyssinian Sorrel.

6. Plants which impart to milk a peculiar color, after being eaten by cows: (a.) reddish: *Galium verum*, L., Yellow Bedstraw; *Rubia tinctorum*, L., Madder. The same is said of species of *Carex*, *Scirpus*, *Equisetum*, *Ranunculus*, *Euphorbia*, and of young twigs of pine, etc. (b.) yellowish: *Daucus carota*, L., Carrot; *Rheum palmatum*, L., Rhubarb. (c.) blue: *Anchusa officinalis*, L., and *A. tinctoria*, L., Alkanet; *Butomus umbellatus*, L., Water Violet; *Melampyrum arvense*, L., Purple Cow-wheat; *Mercurialis perennis* L., Perennial Mercury; *Polygonum aviculare*, L., Common Knot Grass; *Polygonum Fagopyrum*, L., Buckwheat; *Rhinanthus major*, L., Yellow Rattle.

7. Plants which impart a peculiar, often acrid taste to milk: *Allium ursinum*, L., Ramsons; *Artemisia absinthium*, L., Wormwood; *Brassica napus*, L., Rape; *Brassica rapa*, L., Wild Turnip; *Euphorbia cyparissias*, L., Cypress Spurge; *Gratiola officinalis*, L., Hedge Hyssop; *Helleborus niger*, L., Black Hellebore; *Matricaria Chamomilla*, L., German Chamomile; *Zea mays*, L., Maize; —*From Industrie Blätter.*—*New Remedies.*

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Wanted—A Manganese Property. Address Fuller & Stillman, 61 Broadway, New York.

A Machinist and Inventor desires a situation where inventive and constructive ability would be serviceable. Models designed and constructed, or inventors assisted in working out ideas. Address R. Williams, 43 Fourth St., Brooklyn, E. D., N. Y.

Models made to order. H. B. Morris, Ithaca, N. Y.

For Sale.—About 4 tons fine Corundum; from No. 100 to dust. The J. Morton Poole Co., Wilmington, Del.

For Pat. Safety Elevators, Hoisting Engines and Machines, Friction Clutch Pulleys, and Cut-off Coupling, see ad. p. 61.

To Fertilizer Manufacturers.—A chemist experienced in this line is open to a two months' engagement. Will furnish apparatus and chemicals. Address F. C. B., P. O. Box 778, New York city.

Wanted.—A Second-hand Turbine Wheel. Give price and dimensions. Address E. L. Pemberton, Fayetteville, N. C.

The "Fitchburg" Automatic Cut-off Horizontal Engines. The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

The steam pipes, boilers, etc., of the Delamater Iron Works, Borden Iron Works, and the Municipal Gas Company, are protected with H. W. Johns' Asbestos Boiler Coverings. H. W. Johns Manufacturing Company, No. 87 Maiden Lane, New York, sole manufacturers of genuine Asbestos Liquid Paints, Roofing, etc.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., etc., sent post free on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Rundell's Mower and Patterns will be sold, or licensed to manufacturers on royalty, to the highest bidder. The sale will be closed March 16, 1880. Pat. Oct. 21, 1878. For further information, inquire or visit the inventor, Wm. F. Rundell, Genoa, Cayuga Co., N. Y.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Launches and Engines. S. E. Harthan, Worcester, Mass.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 45.

Brick Presses for Fire and Red Brick. 309 S. Fifth St., Phila., Pa. S. P. Miller & Son.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 45.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Eclipse Portable Engine. See illustrated adv., p. 45.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 9 cents per pound. Fully warranted.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 62.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Emery Wheels of all kinds, and Machines at reduced prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 30.

Patent Steam Cranes. See illus. adv., page 62.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all sizes agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

$400 Vertical Engine, 30 H. P. See page 62.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 61.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 61.

For Machine Knives and Parallel Vises, see advertisement, p. 61. Taylor, Stiles & Co., Riegelsville, N. J.

The Twiss Automatic Cut-off, also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

NEW BOOKS AND PUBLICATIONS.

BLOWPIPE ANALYSIS. By J. Landauer. Translated by James Taylor and William E. Kay. London: Macmillan & Co. 12mo, pp. 161. Price $1.50.

Differs from the usual run of works on blowpipe analysis in treating the matter entirely from a chemical point of view. In this way the author has sought to make blowpipe analysis more useful to the chemist without its losing any of its value to the metallurgist and mineralogist. The book is well indexed, and in every way shows the good workmanship characteristic of the house whose imprint it bears.

TREATISE ON FUEL. By Robert Galloway. London: Trübner & Co. pp. 136.

A scientific and practical text book for students in the higher schools and colleges, the subject being wisely kept within narrow limits. The one obvious lack of the book is a good index.

SOME PRACTICAL HINTS ON WOOD ENGRAVING. By W. J. Linton. Boston: Lee & Shepard.

The explanatory line on the title page "for the instruction of reviewers and the public" will prevent any unreasonable expectation from students of the practical art of engraving. As a bit of retaliatory criticism the book is entertaining.

MANUAL OF EXHIBIT BOOKKEEPING, INTRODUCING A SIMPLIFIED METHOD OF KEEPING AND AUDITING ACCOUNTS. By Selden R. Hopkins. New York: The Hopkins Company, publishers.

A work of rare simplicity and practical utility, and as unconventional as it is useful. The system taught is one that any student or business man can easily master and apply, so as to be not only able to tell at all times exactly how his affairs stand, but to do it with much less labor and liability to error than by the more complicated systems of book keeping usually employed.

MEMOIRS OF THE SCIENCE DEPARTMENT, UNIVERSITY OF TOKIO, JAPAN. Vol. I., part 1. Shell Mounds of Omori. By Professor Edward S. Morse. Tokio: Published by the University. 1879.

The Omori shell mounds lie on the western side of the Imperial Railway between Yokohama and Tokio, nearly six miles from Tokio and half a mile from the Bay of Yeddo. Like the prehistoric shell mounds in other parts of the world they contain abundant vestiges of the race which anciently inhabited the country, in fragments of human bones, pottery, and implements of bone and stone. Typical forms of a large number of such specimens are figured in the seventeen plates of this memoir. Though of high scientific value this first publication of the University of Tokio has an equally high industrial interest. All the figures were drawn and engraved by Japanese artists, and the composition and press work have been done by Japanese unable to speak English. The paper and binding are also Japanese. That such good work should be done under so many unfavorable conditions is much to the credit of these Yankees of the far East.

AROUND THE WORLD WITH GENERAL GRANT. By John Russell Young. New York: American News Company. 20 parts. Price 50 cents each.

The first five parts of the well written and handsomely illustrated record of travel were noticed some months ago. Parts six to ten finish Europe and carry the party to India. Burmah and Farther India are described in the thirteenth and fourteenth parts. The promise of the early numbers has been admirably fulfilled.

THE MAGAZINE OF ART. New York: Cassell, Petter, Galpin & Co. Price $2.75 a year.

In addition to forty pages of letterpress with many engravings, the December number of this popular magazine contains three full page illustrations as follows: The Cassia, from a painting by Luke Fildes, A.R.A.; Christ and Mary Magdalen near the sepulcher, by Albano; and the First Roebuck, by A. Eberle.

ODDMENTS OF ANDEAN DIPLOMACY. By Hinton Rowan Helper. St. Louis: W. S. Brian.

Chiefly devoted to a history of the claim of J. H. Colton against Bolivia for map engraving, and the Fisher claim against Brazil for charter money for the steamship Circassia engaged in transporting emigrants to Brazil. Incidentally Mr. Helper's main "oddment" is developed, namely a project for an 8,000 mile double track steel railway "from the westerly shores of Hudson Bay to the midway margin of the Strait of Magellan."

DOUBLE STAR OBSERVATION MADE IN 1877-8 AT CHICAGO WITH THE 18½ INCH REFRACTOR OF THE DEARBORN OBSERVATORY. By Sherburne Wesley Burnham, M.A. Reprinted from the Memoirs of the Royal Astronomical Society. Vol. XLIV.

Comprises I., a catalogue of 251 new double stars, with measures. II., micrometrical measures of 500 double stars, making a total of more than 1,400 micrometrical measurements. Many of the new doubles are naked-eye stars, and some of the most interesting class. These observations are the first contribution of the Great Equatorial of the Dearborn Observatory.

TEA CULTURE AS A PROBABLE AMERICAN INDUSTRY. By Wm. Saunders, of the Department of Agriculture. Washington: Government Printing Office.

This special report of the Department of Agriculture contains the valuable paper read by Mr. Saunders before the New York Horticultural Society, last October and duly noticed in the SCIENTIFIC AMERICAN at the time.

BORIES' UNIVERSAL POISON REGISTER. Dayton, Washington Territory: Emil Bories, publisher.

This is a blank book for recording sales of poison by druggists and others. Spaces are provided for entering the name of the poison sold, the quantity, by whom purchased and for whom, the date of sale, the alleged purpose for which the poison is bought, the name of the seller, and the residence of the purchaser. Though intended specially to meet the requirements of the laws of Washington Territory relative to the sale of poison, this record would be convenient and useful for all druggists, and if faithfully kept would have much legal and sanitary value.

BUILDING SAFE GUIDE. By Charles Marcotte, Architect. St. Louis: Slawson & Pierrot. 12mo, paper, pp. 136. Price $1.

Mr. Marcotte has evidently had not a little unpleasant experience with tricky contractors and artisans in the building trade, and gives the world the benefit of his knowledge with the least possible reserve. He claims that his main object is the protection of owners, agents, architects, mechanics, and others engaged in the building trade; and to further this end he gives, in addition to much practical information relative to the safe transaction of building business and the materials and qualities of workship in all the trades connected therewith, a general exposure of the various frauds practiced by dishonest contractors, builders, and mechanics.

HUBBARD'S RIGHT HAND RECORD AND READY REFERENCE FOR LEADING ADVERTISERS. New Edition. New Haven, Conn.: H. P. Hubbard, Newspaper Advertising Agent.

A convenient hand book for advertisers, containing a list of all the periodicals published in the United States and Canada, arranged in order, with population of towns, the circulation of the papers, and blank spaces for recording contracts, estimates, acceptances, etc.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) M. M. L. writes: I have about 6 cells of a battery, of which the outer cup is zinc, and into this fits a porous cup containing an iron core. What is such a battery called, and what fluids are used in it? A. Are you quite sure the core is iron? It should be carbon, and if it is carbon the battery is a modification of Bunsen's, and requires a bichromate solution in the porous cell and dilute sulphuric acid in the jar. See Batteries, in SUPPLEMENTS 157, 158, and 159.

(2) T. A. R. asks if there is any difference between applying an engine in the center, and at one end of a line of shafting 400 feet long? A. When power is applied to one end of a long line of shafting the speed of the machinery driven from the other end will be irregular owing to the spring of the shaft; for this reason it is better to apply the power to the center of the shaft.

(3) T. E. M. writes: 1. I am investigating the subject of a cheap household motor with power sufficient to drive sewing machine, churn, washing machine, etc. How would compressed air answer the purpose? A. Very well. 2. Could a common wind engine, such as is used on prairies for pumping, be used successfully to compress the air for the above purpose? A. Yes. 3. If so what size would be sufficient? A. This would depend upon the amount of power and the number of hours per day it is used. 4. Are there any air compressors in the market and at what price? A. There are large compressors driven by steam engines, prices according to size. 5. Name a good work on the steam engine, cheap work, for practical engineers. A. "Roper on Land and Marine Engines."

(4) L. P. D. asks: 1. Can the deepest portions of the ocean be sounded? If so, how? A. They have not been sounded; the deepest soundings yet taken was about 4,600 fathoms. 2. Some claim that heavy bodies will not sink in the ocean only to a certain depth, according to their specific gravity. A. Bodies of but little greater specific gravity than water will sink to the bottom.

(5) E. A. B. asks how to paint on silk. A. Stretch the silk over a board or upon a "stretcher" and paint with ordinary water colors.

(6) J. M. S. writes: I notice in SCIENTIFIC AMERICAN, for October 11, 1879, in "Notes and Queries," in answer to H. B., referring to the wear of locomotive cylinders, you say: "Do they wear most at the ends: if so they wear differently from all other steam cylinders." A moment's observation should satisfy you that they do, and that all other steam cylinders do also. Is not the pressure greatest at the ends of the cylinder, and the piston packing tighter at that point than at any other? I have never measured a cylinder that has run any length of time but what I find it largest at the ends. A. In the class of pistons in which the rings are forced outward by steam pressure, it may be true that the wear is greatest at the ends of the cylinder; but in the case of ordinary packing rings, where the pressure and friction are the same throughout the stroke, the wear will be nearly uniform.

(7) C. F. H. asks how he can get on walnut the fine finish like that seen on pianos. Have tried shellac varnish and a polish of two parts shellac and one boiled oil applied with a cloth and rubbed until polish appears. A. Apply the Wilson wood filler; when it becomes dry, give the work two coats of rubbing varnish; when this becomes thoroughly dry and hard, rub down with pumice stone and water, and then with rotten stone and water. Wash the work, allow it to dry, and lastly, apply a coat of fine flowing varnish.

(8) S. V. asks for formula for blacking transits, theodolites, etc. A. Apply to the cleaned brass surface a mixture of 4 parts of hydrochloric acid and 1 part of arsenic (by weight). Wash, dry, and lacquer.

(9) A. H. J. asks: If a cannon ball and a rifle ball be fired from opposite directions and meet on a straight line, and the cannon ball being the heavier and does not cease motion but takes the rifle ball back again, does the rifle ball cease to have motion at the time of meeting? A. Yes; the motion of the rifle ball cannot be reversed, without there being a point in time when it has no motion in either direction.

(10) J. F. A. asks: What would be the proper size engine and wheels for a boat (flat bottom) 80 feet long, 14 feet beam; how many miles per hour would she make? A. With a pair of 9 inch cylinders having 2 feet stroke, and with wheels 10½ feet diameter, the speed would be about 8¼ miles per hour.

(11) E. H. asks for information in regard to nickel plating, and wants something that can be applied to iron or steel, and if possible without battery or other apparatus. A. We know of no satisfactory way of plating iron or steel with nickel without electricity. You will find an article on the subject on p. 289, Vol. 38, SCIENTIFIC AMERICAN.

(12) F. H. writes: One telegraph wire, ordinary size, is attached to the house, by means of an ordinary insulator fixed to the window framing. At nearly all times of the day or night I am troubled by a humming noise, more or less loud, but at all times very disagreeable. Is there no simple means of preventing this annoyance? The house stands on the brow of a hill, exposed to the winds, but I have noticed the humming noise is frequently very loud when the air is quiet. What I would like is to find the cause and the cure for the trouble. A. The noise referred to is produced by the vibration of the wires by the wind. A slight and almost imperceptible breeze is sufficient to set the wires in motion. The remedy is to attach to the wire between its supports a string or wire, and attach it to some fixed object. If a wire is used it should of course be insulated.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

F. A. P.—Iron pyrites, sulphide of iron.

COMMUNICATIONS RECEIVED.

Questions for Botanists. By G. A. H.

On the Decrease in the Speed in the Earth's Rotation. By H. F.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 30, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Ads eyes, die and punch for forming, L. Chapman (r) 9,057
Alloys, solution for depositing nickel, Friedmuth & Van Trunk 223,210
Annunciator, speaking tube, J. R. Creighton 223,119
Ash chute for buildings, Abendroth & Mersereau 223,089
Axle, car, C. B. Barnes 223,096

Axle, vehicle, E. A. Wilde 223,203
Bale tie, J. Johnson 223,162
Bale tie, E. C. Singer 223,071
Baling press, La Dow & Ensminger 223,152
Barrels, canvas cover for, F. G. Johnson 223,064
Bat, game, J. O'Neill 223,160
Beam puller, H. B. Morrison 223,003
Bearing, adjustable, C. G. Burkhardt 223,000
Beehive, G. W. Sharp 223,022
Bell striking mechanism, W. E. Sparks 223,073
Bell striking mechanism, door, W. E. Sparks 223,074
Belt gearing and shifting mechanism for applying driving power with varying speed, J. S. Detrick 223,119
Billiard table, G. Bayliff 223,104
Billiard table attachment, C. Dimion 222,718
Blotter, E. J. Trum 223,198
Book, speaking picture, T. Brand 223,109
Boot and shoe, J. L. Joyce 223,145
Boot and shoe heel edge polishing machine, J. H. Ryder (r) 9,010
Bottle stoppering machine, A. M. Bacon 223,027
Bottles, jars, and pots, stoppering and covering, C. Mare 222,900
Bracelet, W. Hamilton, Jr. 223,048
Bran cleaning machine, J. Mills 223,057
Bran scouring machine, W. C. Turner 223,091
Bricks, manufacture of gravel, G. N. Turee 223,018
Bridge irons, machine for making, J. W. Seaver 223,011
Bridle brow band, E. B. Cahoone 223,030
Brush wheel, scouring, J. A. Spence 223,016
Bung, C. G. Singer 223,070
Can, H. H. Hull 222,946
Canning food, H. Warden 223,093
Capsules from moulds, device for removing, F. A. Hubel 223,140
Capsules, machine for cutting off gelatine, F. A. Hubel 223,139
Car coupling, C. Truepe 223,079
Car draw bar, railway, G. F. Godley 223,130
Car seat attachment, F. W. Coulbaugh 223,001
Carpet cleaner, T. A. Naylor 223,158
Carpet lining, W. S. Hunt 223,047
Carriage fender, L. H. Wooden 223,206
Carriage seat lock, C. Robinson 223,008
Cartridge holder, W. H. Bell 223,100
Caster, furniture, O. Pedersen 223,182
Casting metal tubes, machine for, S. F. M. Tasker 223,077
Centrifugal and screw ventilator, F. Pelzer 223,185
Cereals, prepared, L. S. Chichester (r) 9,006
Chair, J. F. McClain 223,156
Check book, W. M. Blain 223,029
Cigar puncturing device, P. B. Wight 223,020
Clasp, C. V. Richards 223,170
Clothes pounder, S. Rea 223,167
Clothes pounder, M. F. Smith 223,178
Clothing, manufacture of, H. C. Elliot 223,122
Coal washing machine, S. Stutz (r) 9,011
Collar cap, horse, J. P. Schmitz 223,174
Coloring fibrous material, H. W. Vaughan 223,019
Colter, rolling, J. Lann 223,161
Convertible chair, A. A. Brick 223,109
Cotton openers, beater for, R. Gillmon 223,039
Counter support, metallic, C. E. Bigelow 223,026
Crucible furnace, Reichhelm & Koester 223,007
Currycomb, Holmes & Lawrence 223,137
Dental articulator, J. H. McPherson 223,157
Drilling machine, N. & M. Remmel 223,168
Drying machine, G. N. Bliss 222,992
Electricity, motor for measuring, B. F. Card 223,112
Fare register, W. H. Hornum (r) 9,008
Fare register, Hunt & Preston 223,046
Faucet, J. Mills 222,904
Felly plate, C. Cremer 223,032
Fence post, iron, J. Carpenter (r) 9,005
Fertilizer dropper and hill marker, combined, G. H. Pease 223,065
Fifth wheel, vehicle, D. M. McMaster 223,001
Firearm, breech-loading, C. Foehl 222,001
Firearm, revolving, W. H. Bell 223,101
Fire extinguisher, W. Neracher 223 159
Fishing line attachment, W. F. Yachn 223,194
Flue cleaner, Gohr & Richards 223,040
Fly screen, Wilson & Bolinger 223,205
Food for invalids, T. T. Gaunt 223,039
Fruit drier, W. D. Mumbrue 223,059
Fumigating purposes, composition for, Nicholls & Bryen 223,004
Furnace, W. D. Smith 223,181
Furnace grate, H. E. Williams 223,097
Furs, taping, E. R. Volkel 223,198
Gas regulator, J. S. De Palos 223,084
Gear cutting machine, T. Wolcott 223,098
Grain, apparatus for degerminating, J. Mills 223,056
Grain binder, S. D. Locke (r) 9,004, 9,005
Grain binder, sulky, E. Doderick 222,996
Grain cleaning and scouring machine, L. Langevin 223,153
Grain decorticating apparatus, F. X. Stielenhofer 223,184
Grain elevating and moving apparatus, P. Ely 223,036
Grain separator, W. Workman 223,021
Grain toiler, H. E. Douglass 223,034
Grave guard, A. Hank (r) 9,009
Grinding mill burr, G. & A. Raymond 223,166
Hame, canning, J. W. Black 223,106
Harness spring attachment, W. Warwick 223,095
Harvester, E. W. Skinner 223,014
Harvesting, thrashing, and cleaning machine, combined, A. N. Verdery 223,195
Hat pouncing machine, W. Keenan 223,144
Hat sweat, C. Sinis 223,177
Hay rake, horse, J. H. Thomas 223,078
Hay unloader, J. Tyler 223,092
Hinge, T. M. Foster 223,127
Hoisting and elevating apparatus, E. S. Cunningham 223,033
Horse power, Wade & McAnlay 223,197
Horse rake, D. P. Sharp 223,012
Horseshoes, manufacture of, G. Bryden 223,111
Hose, etc., coupling, W. J. Stevens 223,190
Hydrocarbon burner, F. M. Wareham 223,094
Inhalation, device for medicinal, J. V. Morrison 223,058
Iron, composition for softening cast, Holton & Abbey 223,138
Ironing machine apron, R. K. Smith 223,180
Jar and can, Shirley & Rhind 223,013
Land roller and clod crusher, comb'd, S. J. Fisher 223,125
Latch, C. C. Coleman 223,113
Lathe, engine, A. B. Beau 223,099
Life boat, G. B. Berrell 223,035
Loom shedding mechanism, E. Wade 222,191
Lubricator, J. Smith 223,016
Malt turning machine, F. Weinig 223,096
Mashing process, A. E. Feroe 223,210
Measuring cabinet for oils, H. W. Hatch 223,041
Meat cutter, D. W. Garst 223,129
Medical compound, W. E. Rinis 223,169
Milk can, C. C. Fairbanks 222,980
Milk cooler, G. C. Neubaen 223,162
Miter gauge, W. W. Mackey 223,055
Musical instrument, mechanical, G. H. Arno 223,024
Nailing machine, E. C. Lambert 222,987
Oils, treating linseed and kindred, D. D. Cattanach 222,996
Ore separator, Bennett & Burnham 223,102

Packing for rotary engines, R. Schnockenburger 223,173
Paper cutter, J. A. Berstler 223,103
Paper for bank checks, etc., safety, J. Hendrichs 223,136
Paper perforating machine, J. W. Ross 223,176
Passenger and time recorder, R. M. Rose 223,171
Paste, preparing, H. H. Beach 223,024
Pedal, G. W. Neill 223,062
Phosphorescent substance, A. Krause 223,050
Photographic printing frame for solar printing, C. A. Gale 223,128
Piano action frame, C. F. T. Steinway (r) 9,012
Pianoforte action, C. F. T. Steinway (r) 9,013
Pianoforte action, upright, G. W. Neill 223,060
Piano lid, E. B. Scattergood 223,178
Planing machine cutter heads, etc., machine for grinding the bits of, W. C. Stetson 223,076
Planter, convertible cotton, W. T. Willis 223,204
Planter, corn, F. W. Shellsbarger 223,069
Planter, seed, J. A. Kirkpatrick 223,148
Planters, check row attachm't to corn, J. Thomson 223,190
Plow, H. H. Ackley 222,979
Plow, W. L. Barton 222,980
Plow, L. Chapman 222,984
Plow mould board, J. W. Fields 223,124
Plow, sulky, H. C. Stuart 223,186
Potato digger, C. A. King 223,147
Potato digger, J. B. Taylor 223,189
Pressure indicator, electrical, T. Shaw 223,068
Printer's quoin, Turach & Lee 223,192
Printing press feed gauge, Marshall & Sparrell 223,055
Privy seat, J. J. Gorman 223,131
Pump, E. Martin 223,000
Pump, C. J. Swanson 223,188
Pump bucket, chain, M. C. Bignall 223,104
Pulp tube machine, G. Rinne, Jr. 222,961
Railway chair, J. R. Sullivan 223,187
Railway rails, elastic seat for, G. L. Mack 223,052
Railway switch, G. S. Bastright 223,098
Range, steam cooking, J. Ashcroft (r) 9,004
Reclining chair, G. A. Doolinger 223,120
Refrigerator, T. H. Marks 223,146
Reservoir, automatic air tight, M. B. Stafford 223,075
Rolling wrought metal tires for traction wheels, F. L. Fairchild 223,122
Sad iron heater, J. F. Curtiss 223,116
Saddle girth ring, Jahnke & Swank 223,143
Saddle, harness, J. H. Gwinnell 223,042
Sails, reefing and furling, H. Flowers 222,999
Saw mill head block, J. P. Barnard 223,094
Scissors, A. Sanders 223,172
Scraper and leveler, road, E. D. Dague 223,117
Scraper for door mats, W. E. Lawrence 223,154
Screw, ornamental headed, R. B. Tunstall 223,080
Sewing machine tension regulator, G. Hall, Jr. 223,133
Sewing machine tuck marker, J. Bolton 223,107
Shafts, wheels, or pulleys, device for driving, stopping, and reversing, Bates & Hartmann 223,097
Sled shoe fastening, B. F. Manning 223,054
Sleigh shoe, N. W. Chubbuck 222,985
Sleigh shoe, A. A. & J. H. Nichols 223,062
Slop jar, M. Stransky 223,186
Spark arrester for smoke stacks, D. J. Timlin 223,191
Stamp canceling device, Egerton & Snell 223,036
Stamp, perforating, H. H. Norrington 223,163
Stave, and vessel formed of staves, J. Donald 222,997
Steam brake, G. W. Miles 223,032
Steam conducting pipe, G. P. Smith 223,072
Steam engine lubricator, P. Barclay 223,002
Steam engine, portable, H. K. Kriebel 223,098
Stone dressing or millstone pick hammer, C. T. Farnham 223,123
Stone sawing machine, A. G. Osgood 223,164
Stove, heating, W. A. Greene 223,043
Stove pipe shelf, H. S. Kratz 223,150
Surgical splint, W. W. Koehler 223,049
Tablet, writing, C. L. Fiske 223,126
Tanning, I. Wells 223,200
Target, flying, T. Bakewell 223,025
Tea kettle, J. Hambitzer 222,905
Telephone exchange, auxiliary, G. Westinghouse, Jr. 223,201
Telephone switch, automatic electric, E. T. Greenfield 223,132
Telephone switch for connecting local lines by means of main lines, automatic, G. Westinghouse, Jr. 223,202
Tire fastening for vehicle wheels, C. H. Starkey 223,182
Tobacco, treating, E. Finzer 222,999
Tomb or vault, artificial stone, W. M. Arnold 223,100
Tongs, spring, H. R. Russell, Jr. 223,066
Tool handle, R. K. Kidder 223,146
Toy, J. R. Hawes 223,045
Traveling bag fastener, J. B. Brooks 223,110
Tree fender, Barnhill & Payne 223,098
Truck, adjustable stove, W. H. Tucker et al. 223,087
Truck, car, Wyatt & Smedley 223,207
Truss, J. L. Rowe 223,009, 223,010
Tube bending machine, J. M. Evarts 223,087
Vapor burner, E. M. Lowden 223,051
Vehicle, J. G. Oulson 223,063
Vehicle spring, W. P. Kelley 223,145
Vehicle spring, J. H. Kleppinger 223,149
Vehicle wheels, device for taking off, O. Ward 223,199
Velocipede sled, J. H. Dennis 223,118
Ventilation, house, Pierson & Burnett 223,006
Wagon, platform spring, Halfpenny & Simmons 222,902
Waterwheel, S. M. Smith 223,179
Wick trimmer, A. Blanchard 223,027
Windmill, C. J. Hamilton 223,134
Window fastener, G. B. Mann 223,000
Window shade roller, J. Shorey (r) 9,008
Windows, guard railing for, A. Bischoff 223,105
Wire ropes, machine for tarring, B. Cotter 223,114

The Scientific American EXPORT EDITION.

PUBLISHED MONTHLY.

THE SCIENTIFIC AMERICAN Export Edition is a large and SPLENDID PERIODICAL, issued once a month, forming a complete and interesting Monthly Record of all Progress in Science and the Useful Arts throughout the World. Each number contains about ONE HUNDRED LARGE QUARTO PAGES, profusely illustrated, embracing:

(1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its SPLENDID ENGRAVINGS AND VALUABLE INFORMATION.

(2.) Prices Current, Commercial, Trade, and Manufacturing Announcements of Leading Houses. In connection with these Announcements many of the Principal Articles of American Manufacture are exhibited to the eye of the reader by means of SPLENDID ENGRAVINGS.

This is by far the most satisfactory and superior Export Journal ever brought before the public.

Terms for Export Edition, FIVE DOLLARS A YEAR, sent prepaid to any part of the world. Single copies, 50 cents. For sale at this office. To be had at all News and Book Stores throughout the country.

NOW READY.

THE SCIENTIFIC AMERICAN EXPORT EDITION FOR JANUARY, 1880, ILLUSTRATED WITH EIGHTY-NINE ENGRAVINGS.

GENERAL TABLE OF CONTENTS

Of the SCIENTIFIC AMERICAN Export Edition for January, 1880.

Answers to Correspondents, embodying a large quantity of valuable information, practical recipes, and instructions in various arts.

Single numbers of the *Scientific American Export Edition*, 50 cents. To be had at this office and at all news stores. Subscriptions, *Five Dollars a Year*; sent postpaid to all parts of the world.

MUNN & CO., PUBLISHERS,
37 PARK ROW, NEW YORK.

To Advertisers: ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The Scientific American Export Edition has a large guaranteed circulation in all commercial places throughout the world. Regular Files of the Export Edition are also carried on ALL STEAMSHIPS, foreign and coastwise, leaving the port of New York. Address MUNN & CO., 37 Park Row, New York.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

An American Book on the Beet Sugar Industry.

Ware on the Sugar Beet.

JUST READY.

The Sugar Beet; including a History of the Beet Sugar Industry in Europe, Varieties of the Sugar Beet, Examination, Soil, Tillage, Seed and Sowing, Yield and Cost of Cultivation, Harvesting, Transportation, Conservation, Feeding Qualities of the Beet, and of the Pulp, etc. By Lewis S. Ware, C.E., M.E., Fellow of l'Ecole Centrale des Arts Agriculture et Manufactures, Paris; Member of the American Chemical Society. Illustrated by 90 engravings. 8vo. Price $4, by mail, free of postage.

This is one of the most important books which have issued from the press for a very long time, and is upon an industry of great interest to the people of the United States, who annually consume $80,000,000 worth of foreign sugar, all of which might be produced at home.

The above or any of our books sent by mail, free of postage, at the publication price.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo; a Catalogue of Books on Dyeing, Calico Printing, Weaving, Cotton and Woolen Manufacture, 4to; Catalogue of a choice collection of Practical, Scientific, and Economic Books, 4to; List of Books on Steam and the Steam Engine, Mechanics, Machinery, and Engineering, 4to; List of Important Books on Metallurgy, Metals, Strength of Materials, Chemical Analysis, Assaying, etc., 4to; List of Books on Mining, Mining Machinery, Coal, etc., 4to; two Catalogues of Books and Pamphlets on Social Science, Political Economy, Banks, Population, Pauperism, and kindred subjects; also a Catalogue of recent additions to our stock of Practical, Scientific, and Technical Books, sent free to any one who will forward his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.

WANTED TO BUY FOR CASH.—A Milling or Routing Machine, to be used on Brass Dies for Books. State price and description. Address T. C. KURTZE, 115 Franklin St., Chicago, Ill.

VIRGINIA FARMS.

Catalogue sent free. Now is the time to buy. Maps of Virginia, 25c. CHAFFIN, STAPLES & CO., Richmond, Va.

FOR SALE.

Canadian Letters Patent No. 7,728, Forster's Lamp Stand, price $250 and United States Patent No. 169,105, for $400. Only neck holder known. He will let on royalty to a good firm. Address JOHN FORSTER, Coal Valley, Rock Island Co., Illinois.

Sawing off a Log, Easy and Fast.

Our latest improved sawing machine cuts off a 2-foot log in 2 minutes. A **$100 PRESENT** will be given to two men who can saw as much in the old way, as one man can with this machine. Circulars sent free. W. GILES, 741 W. Lake St., Chicago, Ill.

CAUTION.—Any sawing machine having a seat for the operator, or treadles for his feet, is an infringement on our patents, and we are prosecuting all infringers. SO BEWARE WHOM YOU BUY OF.

United States Patent for sale cheap. Well tested. Address C. H. Warrington, Box 68, West Chester, Pa.

STEP LADders are necessary; clothes frames valuable; ironing tables indispensable; but combined all in one and sold for $1 is the combination to irresistible. Every family will have one. Send for it. Agents supplied. Rights for sale. Address J. H. MARTIN, Hartford, N. Y.

PIANOS-ORGANS

CHEAPEST HOUSE IN AMERICA. 1st-class Instruments, allowing for cash or installments. Warranted 6 years. Illustrated catalogues free. Agents wanted. T. LEEDS WATERS, Agt., 28 West 14th st., New York.

MANUFACTURERS OF MACHINES FOR making ice from Petroleum by heat are requested to send descriptive circulars, testimonials, etc., to

J. ADDISON,
Care Washburn & Moen Co.,
31 Cliff Street, New York.

Baker Rotary Pressure Blower.

(FORCED BLAST.)

Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA.

TELEPHONE Works 1 mile. Price $3.50 Pat'd. Circulars free. HOLCOMB & Co., Mallet Creek, Ohio.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

THE

Literary Revolution

AND

Universal Knowledge.

An Encyclopedia in 20 vols., over 16,000 pages; 10 per cent. more matter than any Encyclopedia ever before published in this country, and sold, handsomely and well bound in cloth, for **$10.00**, in half morocco for **$15.00**, and printed on fine heavy paper, wide margins, bound in half Russia, gilt top, for **$20.00**—an enterprise so extraordinary that its success, beyond all precedent in book publishing, may be fairly claimed to inaugurate a *Literary Revolution*.

The LIBRARY OF UNIVERSAL KNOWLEDGE is a reprint entire of the last (1879) Edinburgh edition of "Chambers' Encyclopedia," with about 40 per cent. of new matter added, upon topics of special interest to American readers, thus making it equal in character to any similar work, better than any other suited to the wants of the great majority of those who consult works of reference, and altogether the latest Encyclopedia in the field.

Specimen Volumes in either style will be sent for examination, with privilege of return on receipt of proportionate price per volume.

Special Discounts to all early subscribers, and extra discounts to clubs. Full particulars with descriptive catalogue of many other standard works equally low in price, sent free. Mention this paper.

AMERICAN BOOK EXCHANGE,
TRIBUNE BUILDING, New York.

MANUFACTURERS OF WOOD WORKing Machinery and of the best appliances for manufacturing first-class piano cases rapidly and economically, will please send prices and full descriptive catalogues to WILLIAM A. LORENZ, 361 Meserole St., Brooklyn, N. Y.

$100 AGAINST $1.00.

We will deliver FREE for $1.00, with full directions, 1 lb. of our cement paint, and will guarantee to the extent of $100, to cure the most troublesome LEAKS in roofs if properly applied. This cement paint will make twice as durable Tin, a Tube, Pails, etc., when lined with it.
H. D. WASHBURN MFG. CO.,
131 & 133 Congress St., Boston, Mass.

BRADLEY'S Has More Good Points
Does More and Better Work,
Takes Less Power,
Than any Hammer in the World.
BRADLEY & COMPANY,
SYRACUSE, N.Y.

FOR SALE.

Rockville Iron Works. Machine Shop filled with good machinery. Price $1,500. Address ISAAC McFADDEN, Rockville, Park Co., Indiana.

Wood-Working Machinery,

such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON, 26 Salisbury Street, Worcester, Mass. (Shop formerly occupied by R. BALL & CO.)

Dead Stroke Power Hammers

are superior to all others for forging and die work. Over 500 now in use. Manufactured by
PHILIP S. JUSTICE,
14 North 5th Street, Philadelphia, Pa.

NEW BOOKS.

Pocket Book for Chemists, Chemical Manufacturers, Metallurgists, Dyers, Distillers, Sugar Refiners, etc. By Thomas Bayley. $2 00

Concrete: Natural and Artificial. Its varieties and constructive adaptations. By Henry Reid. New edition with colored plates. $6 00

Iron Bridges and Roofs: Elementary theory and calculation of. By August Ritter. Translated from the German by H. R. Sankey. $6 00

Electric Light in its Practical Application. By Paget Higgs. 94 Illustrations of Lamps, Generators, and Regulators. $3 00

Ornamental Penman's and Draughtsman's Pocket Book of Alphabets. 32 plates. $1 00

Spon's Encyclopedia of the Industrial Arts and Manufactures. Written by Practical Men and fully Illustrated. Now being issued in parts at 75c. each.

Supplement to Spon's Dictionary of Engineering. Now being issued in parts at 75c. each.

Catalogues and circulars free on application.
E. & F. N. SPON, 446 Broome St., New York.

AMERICAN JOURNAL OF INDUSTRY

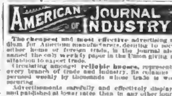
The cheapest and most effective advertising medium for American manufacturers, desiring to secure either home or foreign trade, is the journal above named, the only weekly paper in the Union giving any attention to export trade.

Circulating amongst reliable houses, representing every branch of trade and industry, its columns are perused weekly by thousands whose trade is worth securing.

Advertisements carefully and effectively displayed, and published at lower rates than in any other journal of equal circulation and influence.

For illustrating improved machinery and other products of American invention, this journal has always been highly esteemed by manufacturers and inventors; and the numerous sales effected thereby attest its great value for this purpose.

Bridge Builders, Contractors, Iron Manufacturers, Pipe Founders, etc., wishing to keep advised of all new projects for contract work will find it desirable. Annual subscription to all parts of the world $4. On trial, three months, $1. Address
JOURNAL OF INDUSTRY CO., Pittsburgh, Pa.



THE RANKIN REFRIGERATING CO., Refrigerating Engineers, Apparatus for Manufacturing Ice, Refrigerating Breweries, Packing and Preserving Houses, Ships, Cars, Cooling and Ventilating Public Buildings, etc. Estimates furnished. Office, No. 60 Astor House, New York. THOS. L. RANKIN, Pres., J. W. DORSEY, Vice-Pres., FRANCIS G. BUTLER, Treas.

JOHN R. WHITLEY & CO., European Representatives of American Houses, with First-class Agencies in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E.C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

NEW YORK BELTING AND PACKING COMP'Y.

The Oldest and Largest Manufacturers of the Original

SOLID VULCANITE EMERY WHEELS.

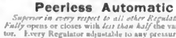
All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.
Emery Wheel. Address NEW YORK BELTING AND PACKING CO., JOHN H. CHEEVER, Treas. NEW YORK.

WANTED—Agents; the caustic process of copying; over 50 impressions from one original writing, sketch, etc.; wonderful success; improvement and universal demand for Jacobs' Lithogram; patented in U. S. and Canada; beware of worthless imitations; sample lithogram and outfit delivered to any address free of charge on receipt of $1. Address J. M. JACOBS, 3 Arch St., Boston, Mass.

SPARE THE CROTON AND SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N.Y., who control the patent for Green's American Driven Well.



BEST AND CHEAPEST FOOT POWER SCREW CUTTING
ENGINE LATHES
SEE FULL DESCRIPTION IN SCIENTIFIC AMERICAN JULY
SEND FOR ILLUSTRATED CATALOGUE
GOODNOW & WIGHTMAN
176 WASHINGTON ST BOSTON MASS.

STEAM PUMPS.

THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.

Peerless Automatic Damper Regulator!

Superior in every respect to all other Regulators.—Controls steam pressure within *one pound*. *Fully* opens or closes with *less than half* the variation of pressure required by any other Regulator. Every Regulator adjustable to any pressure, from one pound upwards. In three months it will *repay cost* in *economy of fuel*, besides insuring steady power, economy of repairs and safety from explosion. Prefer to have pressure mentioned when ordering. Price, $36.50. Thirty day's trial allowed before paying. **American Steam Appliance Co., 13 & 15 Park Row, New York. Sole Manufacturers.** 28 SCHOOL STREET, BOSTON, MASS.

JAMES ECCLES, General Machinist, Inventor, and Maker of the Patent Quadruple Screw Power Press. For the use of Printers, Hosiery Manufacturers and all others who desire great and uniform pressure. 2123 Lombard St., Philadelphia, Pa. ESTABLISHED 1855.

1200 per cent. profit manufacturing our patent Anti-Rattling Clothes Stick; sells at every house. License granted for 5 years, covering any county for $4.00, any township for $1.00, including samples, carriage paid. Address BAUDER & CO., Birmingham, Erie Co., Ohio.

VALUABLE PATENT CHEAP FOR CASH, Revolving Sulkey Harrow. Patented 1878. All territory with exception of Kansas and Missouri. Single States or all. Fortune for right parties. Send for circulars. G. B. GARLK, Corpus Christi, Texas.

Shafts, Pulleys, Hangers, Etc.

Full assortment in store for immediate delivery.
WM. SELLERS & CO.,
79 Liberty Street, New York.

$77 a Month and expenses guaranteed to Agents. Outfit free. SHAW & CO., AUGUSTA, MAINE.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.

For breaking hard and brittle substances to any size. Endorsed by the leading Mining, Manufacturing, and Railroad Corporations in the United States and Foreign Countries. First Premiums wherever exhibited, and hundreds of testimonials of the highest character. Indispensable for making best McAdam Roads, Ballasting of Railroads, Crushing the hardest Ores, Stone for Concrete, etc., etc. Prices greatly reduced. The CHALLENGE was awarded the MEDAL OF SUPERIORITY by the Judges of the American Institute Fair, New York City, December, 1879, where it was exhibited in competition with our old form of Crusher. Address BLAKE CRUSHER CO., New Haven, Conn.

STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.

THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.
STEAM PUMPS—Duplex and Single Cylinder.

Prices below those of any other steam pump in the market.

WATER METERS. OIL METERS.

☞ For Improved Blind Staples and Drivers, Rod Cutters, Blind Stile Borers, address B. C. DAVIS, Binghamton, N. Y.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.

50,000 Agents wanted by 1,000 advertisers in the Agents' Herald, Box 8, Philadelphia, Pa.

THE BEST THING YET. The Fitchburg Acoustic Telephone Co.'s New Metallic Telephone. Send for circulars. FITCHBURG ACOUSTIC TELEPHONE CO., Box 28, Old City, Fitchburg, Mass.

Forster's Rock & Ore Breaker and Combined Crusher and Pulverizer.

The simplest machine ever devised for the purpose.
Parties who have used it constantly for six years testify that it will do double the work of any other Crusher, with one-third the Power, and one-half the expense for keeping in repair. The smaller sizes can be run with Horse Power.
Address TOTTEN & CO., Pittsburgh, Pa.

PATENTS

CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.
BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 6. [NEW SERIES.] NEW YORK, FEBRUARY 7, 1880. [$3.20 per Annum. (POSTAGE PREPAID.)]

FLOATING DERRICKS OF NEW YORK HARBOR.

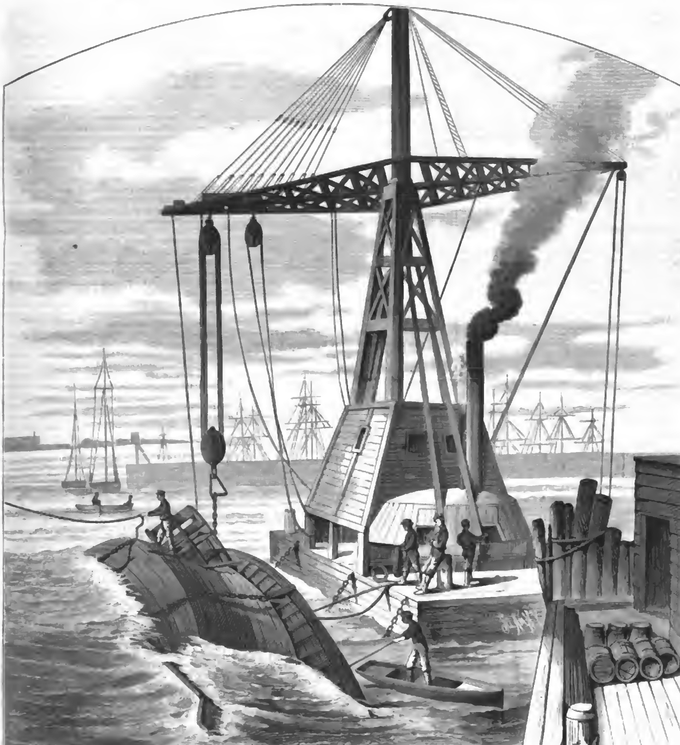
There is no harbor in the world so crowded with shipping of all kinds, propelled in so many different directions, and under so many trying conditions of time and tide, as the harbor of New York; and it is not strange that occasionally a vessel should meet the fate of the Oliphant. It is simply wonderful that accidents are so exceedingly rare, when, in spite of wind and tide, huge ferryboats are constantly crossing the paths of river, Sound, and ocean steamers and sailing craft of all kinds.

The steamboat Oliphant, better known as the Wall street annex boat of the Long Island Railroad, while on her way from the pier at Pine street, to connect with a train at Hunter's Point, was run into by the ferryboat Warren, plying between Grand street, Brooklyn, E. D., and Grand street, New York. The passengers and crew escaped from the Oliphant to the Warren, the latter being only slightly injured. An effort was made to tow the Oliphant to a pier to make her fast, but she capsized before this could be accomplished. The Oliphant was 146 feet long, 140½ tonnage, and was licensed to carry 400 passengers. She was a short time since furnished with new engines and boilers.

Our engraving represents the floating steam derrick E. K. Collins, of the Morgan Iron Works, having its tackle attached to the Oliphant preparatory to righting and raising her. These huge derricks are capable of raising bodily boats of ordinary sizes. Captain McDonald, of this derrick, says he has raised sixty-five sunken vessels with it. Not long since one of the Harlem steamers was sunk on Saturday, was raised on Sunday, and was running again on Monday.

There are in this harbor four floating derricks, ranging in lifting and carrying power from 65 to 100 tons. Two of them are owned by private individuals, one belongs to the Department of Docks, and another to the Brooklyn Navy Yard.

The raising of vessels is but a small part of the work per-



FLOATING DERRICK—RAISING THE WRECK OF THE OLIPHANT, EAST RIVER, NEW YORK.

formed by these huge machines. They are used for transferring heavy freight from vessels to the docks and from the docks to vessels, for placing boilers and machinery in steamers, for lifting and carrying blocks of granite and artificial stone for engineering works, and for handling other bodies too heavy and too bulky to be handled by other means.

The derrick is carried by a large rectangular float well braced and stiffened by trusses. The tower which supports the king post and booms is about sixty feet high, and is built of large timbers well framed and bolted together. The boom is supported by a number of diagonal rods which converge near the top of the king post and are secured to it by heavy forgings which straddle the iron cap at the top of the post. All of the hoisting machinery is placed on the float under the tower and controlled by the engineer.

IRON LIGHTHOUSE FOR MEXICO.

The Keystone Bridge Company, of Pittsburg, are putting the finishing touches to an iron lighthouse ordered for the Mexican Government by Don Vincente Riva Palacia, late Minister of Public Works of the Mexican Government. The work was carried on under the Supervision of Don J. Ramon de Ibarrota, Engineer to the same government. The structure presents an unfamiliar sight to the inhabitants of the smoky city, rearing its graceful proportions high into the air near the banks of the Allegheny River. When completed the lighthouse will be taken apart, shipped by rail to New York, and thence by sea to the mouth of the Tampico River, where the structure is to be put up.

This house is a skeleton structure, made up of seven series or stories of cast iron columns, braced and tied by struts and tie rods, the whole arranged about a central stair cylinder of cast iron, so as to form a hexagonal tower, 146 feet 7 inches high from weathercock to base. The latter is 46 feet in diameter, tapering to 18 feet 10 inches at the lantern room. The lantern and revolving apparatus are awaiting the lighthouse at Tampico, having been made for this structure at Birmingham, England. Just below the lantern is the "service room," for the use of those in charge of the light. This space is roofed with the castings forming the floor of the lantern room, and a neat railing surrounds the hexagonal space embraced in this floor.

The "stair cylinder" forming the central portion of this lighthouse is of cast iron, 7 feet diameter and ½ inch thick, and composed of 14 sections, bolted at the joints through flanges. The spiral stairway inside the cylinder comprises 173 cast iron steps, spaced by six landings, at each of which a window is let into the cylinder. The weight of this whole structure is 150 tons, and its cost at Pittsburg about $15,000. Another will be built for the Mexican coast by the same firm.

Before taking down the lighthouse its stability was thoroughly tested. A pressure was brought to bear against one side equal to a wind strain of 40 pounds per square foot. The area so subjected being 860 square feet, the test was equivalent to 1,800,000 pounds wind strain needing to upset the structure. The momentum of the lighthouse to resist this being 1,840,000, the surplus in favor of stability was still 40,000, and this without any anchorage whatever.

Prosperous France.

France is affording fresh proof that she is one of the most wonderful nations on the face of the earth. The disasters of the Franco-Prussian war, and the payment of five milliards of francs as the further penalty for entering upon that war, would have crippled an ordinary nation. But France is not an ordinary one, and the result is that she has not only cast off her burden, but contemplates an outlay in internal improvements such as the most prosperous country could alone entertain. It will be remembered that M. de Freycinet, the new Prime Minister of France, before leaving his old department, drew up an elaborate report embodying a gigantic scheme for the creation, extension, and union of railways and canals throughout the country. The estimated cost of these improvements is nine milliards of francs, or £360,000,000 sterling; but France is not deterred thereby, and in twelve years the scheme is to be worked out in its entirety. Already France is noted for the completeness of her railway system, which, with her rivers and canals, afford a means of communication apparently leaving little to be desired; but she is impressed with the belief that improvement is possible, and she is going to add 16,000 miles to her railways, and 900 miles to her rivers and canals. This fresh burst of enterprise on the part of France can have but one effect, and that is increased prosperity in the great industries already stirred into activity by the demands of India, America, and the colonies. Rumor is already busy, says our excellent English contemporary *Capital and Labor*, with the names of English firms about to contract with the French Government, while the iron and steel trades in America and Belgium must also benefit.

Interesting to Patentees.

Senator Hoar strongly advises patentees not to spend their money in trying to get their patents extended. He says that experience shows that no bill for the extension of any seventeen year patent can pass Congress. The feeling against the extension of patents is very strong. Bills have passed one house or the other, but they are always beaten in the end. He says that if he had a brother who had a patent worth $50,000, he would not advise him to spend $1,000 to get it extended.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20

One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, FEBRUARY 7, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 214,

For the Week ending February 7, 1880.

Price 10 cents. For sale by all newsdealers.

WORK AND WAGES.

We have been surprised that the volume published a few months since by the National Government on the "State of Labor in Europe," has not received more general attention than it seems to have attracted. The statistics, as furnished by the various United States consuls, purport to cover the rates paid for labor in all the leading industries, together with the cost of living in Great Britain and in nearly every country on the continent of Europe. Elaborate tables are also given comparing the averages thus obtained with the rates of wages paid and the cost of living in this country. In addition to the above, our accomplished Secretary of State, who himself obtained the home statistics relative to labor and the cost of living, carefully edited the volume, and, in an extended introduction, gives us a synoptical résumé of its contents, together with some general conclusions of his own.

Now every one will concede that Mr. Evarts, with his wide and varied culture, is a close reasoner, and there is hardly a subject of general interest on which he cannot write or speak so as to command the attention of all thinking men. In treating of this subject, however, it may well be doubted whether he does not carry his generalizations much too far; for, certainly, the tenor of his whole discourse is to point out that our workingmen must accept lower wages in future. The mechanics and artisans in the housebuilding trades, and in every local as well as general occupation, must, according to his argument, in the near future be content to accept for their remuneration wages more nearly approximating to those obtained by European workingmen. The principal ground on which this reasoning is predicated lies in the much higher rates per day now paid to American workingmen, which, the Secretary argues, cannot be permanently maintained when we are exporting largely of domestic manufactures, in competition with the products of the cheap labor of Europe; yet, in another place, he says: "The average American workman performs from one and a half to twice as much work, in a given time, as the average European workman." It is quite a different thing, as every employer knows, to compare the wages per day or hour of different sets of workmen, from what it is to estimate the cost of labor under differing circumstances, as shown in the completed work. The former method is the one generally adopted by those who talk or write on the subject; the latter must control the operations of all who succeed in every line of business. The English workman who receives the highest average wages in Europe comes nearest to doing as much as the American workman, but on the Continent, where wages are lowest, so also is the quantity and quality of the work. The consul at Leipsic writes that "an active American workman will do as much work in a given time, at any employment, as two or three German workmen," and the volume abounds with such remarks, which do not put the case a whit more forcibly than we have often heard it stated by American manufacturers who have investigated the matter in personal visits to foreign workshops. The fact is, in making comparisons of this kind, so many things have to be taken into consideration to make the conditions equal, that they seldom give one more than an approximate idea of the situation.

But if it is inevitable that we are to have a sort of leveling process in the rates of wages in "the world of educated and progressive labor," why is there not good reason to suppose there will be some "leveling up"? The average rates of labor throughout Europe have advanced from 25 to 30 per cent since 1850. The upward movement was checked when the speculative era following the Franco-German war reached its climax, and since then, contemporary with the extreme depression which was felt here from 1873 to the commencement of 1879, all branches of productive industry have been undergoing a severe strain. This, however, has not caused any very material reduction in the rates paid for labor, and with the first indications of returning prosperity it is probable that wages will at once be advanced in proportion there, as they already have been in many kinds of business here. A great improvement in trade and manufactures has already been experienced in England, notwithstanding the general failure of the crops there the past year, and, although Mr. Evarts' conclusions were formed eight months ago, we have yet to see the evidence that any considerable number of English workingmen are "sorrowfully standing between their idle factories and the emigrant ships."

COTTON SIZE AND COTTON SIZING.

Not long since we had occasion to notice a legal trial in England in which the work of the professional cotton sizer played an important part. From the evidence which the judge required to be given in open court, it appeared that it was a common thing for English cotton goods to be loaded with size, so as to double their natural weight, while in some cases the fiber carried two and a third pounds of size for every pound of pure cotton. In commenting upon the case the judge said that the manufacturer and the warp sizer had entered into a conspiracy to defraud the public; and to the American mind that seemed a fair description of the transaction. English manufacturers and traders, however, do not so regard it.

We have before us a large and well made octavo volume of some three hundred pages ("Sizing and Mildew in Cotton Goods," Manchester: Palmer & Howe), about half of which is devoted to the art of sizing. Its authors are three Manchester chemists of good repute, and in a letter commending the work to our favorable notice, the publishers assure us that this is the first time the subject has been

treated in such an exhaustive manner. That portion of the work devoted to mildew is certainly valuable. The first part is—well, instructive, to say the least, though we sincerely trust that the art, as practiced in England, will not find favor in the eyes of American manufacturers.

Touching the practice of heavy sizing, the authors say in their preface that it does not concern them immediately; still, if there be a demand for weighted cottons, and they are properly described, they see no reason why the demand should not be met. The practice of regarding heavy sizing as an adulteration, they say substantially, in another place, they do not consider at all logical; as they "fail to grasp a parallel that a man commits a fraudulent act who coats a white metal tea service with silver, or plates a set of harness with nickel." They argue that as the manufacturer does not sell direct to the consumer, but to the trader, and simply makes such a line of goods as the trader calls for, therefore the practice of making three pounds of shirting out of one pound of cotton and two pounds of clay and other materials, is perfectly legitimate, or as much so as plating white ware with silver.

The argument would be more convincing and the parallel juster if it were assumable that the makers of plated articles were in all cases well aware that their goods were to be imposed upon unintelligent buyers as pure silver, and took pains to abet the frauds by marking their wares accordingly. The fact that for a time such dishonest products have been disposed of in enormous quantities, as our authors frankly assert, is no proof that there is a real demand for them from consumers, and the loss of favor which English cottons have experienced in China and elsewhere, rather goes to show that many buyers of such goods have been swindled, and that in the long run the practice of overloading cottons will be found the reverse of profitable. But we did not set out to discuss the morality of heavy sizing, or the policy of it, but rather to describe the materials used and the way they are applied.

To a limited extent sizing is a process not only legitimate but really necessary in cotton weaving with single yarn. Its object is to bind the fibers together to strengthen the warp to enable it to withstand the strain of the loom, and to diminish the fraying action of the reed by giving the thread a smooth and even surface. This is especially necessary when the staple of the cotton is short and the fibers but loosely bound together in the spinning of the yarn. For this legitimate purpose starch paste is quite sufficient. With pure starch size it is easy to add 20 per cent to the normal weight of the cotton. By adding other ingredients the loading can be and is increased tenfold or more. To describe the elaborate machinery used in sizing would carry this article beyond the space allowable, besides diverting it from its intended purpose.

The various systems of sizing are classed as follows: 1. Sizing the yarn when on the loom. 2. Sizing in the hank. 3. Sizing the yarn in the warp or chain. 4. Sizing the yarn when spread out so as to represent a sheet, each thread being as nearly as possible at an equal distance from its neighbor. The first method is exclusively practiced by the hand loom weaver, and is of slight importance, very little weaving of that sort being done now except in China and India. For power loom weaving sizing in the hank is exclusively confined to colored goods. This method, like the former, is falling into disuse. The sizing of ball warps and chains is more largely practiced, and consists of two operations, the sizing and the drying. In the first the yarn is run between squeezing rollers to exclude the air, then through a box (sow box) filled with size, then between another pair of rollers to squeeze out the excess of size. The drying is done over steam heated cylinders. The fourth and most important method of sizing is chiefly practiced on the Slasher sizing machine, which sizes and dries the yarn, and otherwise prepares it for the loom by one continuous though complex process.

The authors give an analysis of a sample of heavily sized warp, as follows:

Cotton fiber.	Pure cotton	33·18	
	Natural moisture	2·65	35·83
Size.	Starchy matters	16·16	
	Moisture with size	7·81	
	Fats	3·04	27·01
Mineral.	Natural ash	1·00	
	China clay	32·07	
	Chlorids of magnesium	3·25	
	Chloride of zinc	0·84	37·16
			100·00

Thus it appears that in every hundred pounds of such warp there are about 36 pounds of cotton fiber, 27 pounds of size, and 37 pounds of mineral "loading." In other words, for every pound of pure cotton there is a pound and seven-ninths of foreign matter. A little further on the authors say that "common eight and a quarter pound shirtings are usually very heavily sized," and give analyses of two samples, one showing 3 pounds 6 ounces of size to 4 pounds 13 ounces of cotton, the other giving 3 ounces more of size and so much less of cotton.

The authors are careful to say that sizing and weighting should be considered as two distinct processes. "The former is a necessity, the latter not necessarily so." There is still another loading operation carried on by people called "stiffeners," who take the cloth, after it has been sold by the manufacturers and give it an additional load of clay, gypsum, heavy spar, Epsom and Glauber's salts, starch, tallow, and so on. The authors considerately remark that this practice "cannot, of course, be defended upon any ground save that of cheapening the fabric. Some merchants, however, find this to be necessary;" though it is not easy to see how a finished fabric can be made cheaper even by adding to it so cheap a substance as clay—unless a portion of the clay can be palmed off upon the consumer as cotton. It was shown in the somewhat famous Manchester goods case, a year ago, that the cost of the sizing compound was just 3 farthings a pound, or about one-tenth the cost of cotton. In the case in question the cotton in dispute had 4 pounds of size to 4 pounds 3 ounces of fiber.

The various materials used in sizing are of four classes. (1) Starchy matters used to strengthen the yarn and facilitate the weaving; (2) fatty substances used to soften, that is, to allay the harsh and dusty feel of dry starch; (3) other organic substances; and (4) mineral matter used to increase the weight of the goods. To prevent mildew a large number of antiseptic substances are also employed. All these articles are described at great length, with their special properties and the manner of preparing and using them. For pure sizing the starches most generally used are those of the potato, sago, and wheat. Farina gives a harsher feel than sago, making a more liberal use of fatty matter necessary. Deliquescents are also required, especially when clay has been used, to keep the clothes from becoming dusty. Tapioca, corn starch, rice flour, arrow root, and other starches are often used. In the second class fall tallow, cocoanut oil, palm oil, castor oil, olive oil, animal and vegetable waxes, paraffine, etc. In the third class are glucose, glycerine (which gives a nice soft feel to the cloth, especially in conjunction with much china clay, and which with dextrin and alum makes the dressing for fine muslin yarn), dulcine (a mixture of glycerine, gum, and Chinese wax, introduced into Manchester by two of our authors), Irish moss, glue, old iant, or urine, and various soaps.

In the class of mineral substances we find china clay (disintegrated feldspar), steatite (soapstone or silicate of magnesia), sulphate of lime (plaster of Paris, gypsum, terra alba, etc.), sulphate of magnesia (Epsom salts), sulphate of baryta, or heavy spar, sulphate of soda, or Glauber's salts, silicate of soda, or water glass, and ultramarine blue. All these serve to increase the weight of the fabric. To them are added chloride of calcium mixed with the chlorides of magnesia and zinc for purposes of adulteration.

Chloride of calcium is a deliquescent pure and simple, and serves the purpose of keeping the china clay moist during the weaving process. The authors say that it should never be used for weighting purposes. "Weight can be much more easily and safely introduced by means of china clay than by deliquescent substances." Chloride of magnesium is often used as an antiseptic, but the authors are confident that without an admixture of chloride of zinc it will not prevent mildew.

These various materials variously mixed are applied by the makers of cotton goods to the warp only. The weft is not sized for the weaving process. But this leaves too much unloaded fiber to suit the English merchant. Accordingly, as the authors remark, "it is an established custom to stiffen already heavily sized goods after they have left the manufacturers' hands. Ordinary 7 pound gray shirtings are filled with size, Epsom salts, Glauber's salts, or mixtures of these, so as to make them weigh and resemble, as far as possible, 8¼ pound shirtings." This adulteration is easily seen, since both the warp and the weft threads, and also the interstices, contain foreign matter, "exactly as bleached and filled goods do."

MAKING KNIT COTTON GOODS TO IMITATE WOOL.

When knit shirts and drawers were first introduced, a large proportion of the substance of the goods was wool. The great extent to which cotton is now used in the manufacture of knit undergarments makes it almost ridiculous to speak of these articles of apparel as "flannels." It is now nearly fifty years since the first successful power knitting machine was made. And here, by the way, it may be interesting to remark that, although a hand machine had been in use in England for nearly two centuries, and numerous efforts had been put forth to adapt it to run by power, it was reserved to an American to succeed in this direction. An enterprising storekeeper in Albany, N. Y., saw the need of such an invention, and hired a young man then working in a cabinet shop there to make the attempt. The latter purchased an old hand frame for $55, in April, 1831, on which he commenced his experiments, and in six days had so arranged the apparatus that it would knit by turning a crank at the side.* In the fall of 1832, the invention had become so far a practical success that a small factory was then started to make knit goods with it in Cohoes, N. Y., and the old "reciprocating frame," then first put into use, not only made the fortunes of the storekeeper and the inventor, who set out in so business-like a way to accomplish their object, but started an industry which has since become of vast magnitude.

At first, as we have said, the material used consisted largely of wool. It was not until after several years that it was found that one half cotton would make a good serviceable article, but then and ever since it has been customary to sell these knit undergarments, wherever possible, as woolen fabrics. The experienced housekeeper, or ladies who purchase their own dress materials sufficiently to become somewhat acquainted with the difference between cottons and woolens, probably know better, but the great majority of customers for the goods do not. There are few people, however, we venture to say, who suppose that, in purchasing these goods, they are buying fabrics with absolutely no wool in them. Yet such is really the case in a large proportion of the goods made. It is probable that fully one half of all the knit shirts and drawers made in this country are manufactured from cotton exclusively, and, where any wool is used, it forms a very small proportion of the total weight of the fabric. We know of one manufacturer who, two years ago, made up a lot of goods in which he put twenty per cent wool; but he found it difficult to get more for them than others obtained for an all-cotton article; his conclusion was that fabrics containing so much wool were "too good" for the general market, and he has since used cotton only.

But, with the substitution of cotton for wool, the manufacturers have constantly been making strenuous efforts to produce goods which would look as though they were made of wool. Great attention has been paid to the bleaching and dyeing, and, in making white goods, two or three particular shades of white are given to the fabrics, according as it is desired to represent Texas, Ohio, or California wools, etc. In the dyeing of colored goods, the dyes used are especially intended to give effects which might lead a customer to suppose the goods were made of wool, and colors which will not take well on cotton are avoided. Of course, it is not to be supposed that those who buy and sell the goods are deceived, unless it may be among the small dealers; among those who wear the goods, however, we doubt whether one in fifty would acknowledge wearing undergarments made of cotton alone, and most of them would be extremely indignant at having this fact brought home to them, although every manufacturer knows that hardly one in fifty of those who wear these goods have garments with any appreciable proportion of wool in them.

* Masten's "History of Cohoes."

COMPRESSED AIR IN COAL MINING.

The only mechanical coal digger that ever obtained a foothold in the great Pittsburg coal fields is that now at work in the mines of Henry B. Hays & Bro., near the city named. Its use is regarded with such disfavor by the miners as to warrant the supposition that as a digger it is a practical success. This machine is driven by compressed air, and is a recent invention of Mr. M. H. Lechman, of Columbus, Ohio. In appearance it resembles a Woodworth planer placed low upon the ground and borne upon small wheels running on rails. The mission of the Lechman machine is not, strictly speaking, to mine coal, but to "bear in." This operation by the ordinary method requires the miner to assume a most trying position in order to properly undermine the overhanging mass of coal, which is afterwards dislodged by wedges. Two and a half feet is the extreme "bearing in" distance by hand, and to accomplish this reduces a large amount of coal to an unmarketable state.

The construction of the machine in question is peculiar. The oblong steel frame is double, and capable of elongation, like the joints of a telescope. The forward end of the sliding portion bears a cutter shaft similar to that of a planer. This shaft is armed with serrated cutters resembling in action and form the cutting arrangement of a moulding machine. The shaft bearing these cutters is revolved by means of an endless chain taking power from the driving shaft located across that end of the machine furthest from the cutters. The shaft is driven at 700 to 1,000 revolutions per minute by a pair of upright cylinders located one on each side of the machine. These are 5 inches in diameter and 6 inch stroke, taking air at 60 pounds. Being brought with its forward end against the face of the coal, and 1 foot from the bottom—to clear the stratum of "ground coal"—the machine is ready for action. Air being turned on the cutter bar soon dives out of side as the sliding portions of the digger are moved forward by a suitable screw feed. The cut made is 4 inches deep—perpendicularly—3 feet wide, and extends into the coal seam 5 feet. This cut has been made in four minutes, but usually occupies ten minutes.

Suitable scrapers attached to the endless chains clear away the coal dust produced. When it is considered that a day's work for two able-bodied miners is the "bearing in" 2½ feet across 15 feet of coal, the relative speed of the machine undermining to twice the depth of the miner's pick will be noted. As an offset to this is placed the weight, first cost, and subsequent repairs involved by machine labor. The Lechman machine weighs nearly a ton, costs $500, and needs frequent repairing. The Pittsburg coal seam is a trying test, however, inasmuch as the 4 inches taken out by the cutters includes a double strata of extremely hard slate overlying the bottom or ground coal. As compared to the pick the action of this machine is as the saw to the ax in the felling of a tree or the cutting of a log. There would seem to be a wide field for inventive genius in the matter of a mechanical device that would be free from the objections noted above, and that would not require the conveyance of power from a distance to the cutting device.

EMAIL INK.—The drug house of Louis Muller, in Leipsic, has put on the market colored inks which may be used for writing labels on glass, porcelain, ivory, marble, mother-of-pearl, and metal. The writing is done with a goose-quill, and, when dry, adheres so firmly that it cannot be removed by any liquid. Four different colors are made—black, white, red, and blue.—*Drog. Zeit.*

IMPROVED PORTABLE ENGINES.

We give on this page two views of a compact and simple portable engine manufactured by Messrs. Skinner & Wood, of Erie, Pa. They are made in various sizes, from 2½ to 15 horse power inclusive, and special pains have been taken to adapt them to the smaller industries, also to domestic and agricultural purposes. The manufacturers inform us that they have hundreds of them doing work in printing offices, shops of all kinds, cheese factories, and dairies, in elevators and mines, and on the farm and plantation. These engines in more than ten years of use have earned a reputation for durability and economy, and they are very well and favorably known in many places outside of the United States. The salient features of this engine are its boiler and accessories, its stop motion governor, its self-oiling connecting rod, and the drip catching devices.

The boiler, which is horizontal, is made of the best CH No. 1 iron in cylindrical form, and provided with return flues of the best lap welded iron, and is well arranged for economy and safety. The fire box has a movable bridge wall to adapt it to different kinds of fuel. The grate surface is ample for coal, wood, or shavings, and admits of the use of fuel which could not be used in most small engines in market. The bridge wall is made hollow to admit air to the gas and flame which pass over it, and thus complete the combustion of the fuel, avoiding smoke and the loss of heat generating material.

The stop motion governor, which is fitted to all of these engines, was suggested by the danger and annoyance which follows the breaking or running off of the governor belt. This, we believe, is the first instance of the application of a governor of this kind to portable engines. In case of the breakage of the governor belt, the weighted lever attached to the governor immediately drops and stops the engine. This lever may be adjusted by moving its weight, so as to change the running speed of the engine. The governor needs no readjustment when stopping or starting the engine. It is only in case of the breakage of the governor belt that it requires attention, and then the readjustment is accomplished in a moment.

The connecting rod used with this engine is of steel and of new and peculiar construction. It is provided with bronze boxes of the best quality, which are made hollow in part to receive oil. This forms a very efficient oiler, which does not require filling oftener than once in two or three days. The device for taking up the wear of the connecting rod is both novel and effective.

All of the parts of these engines are made to steel gauges, and may be easily replaced if broken or injured. The makers have studied to give these engines the good qualities of the larger engines, and at the same time to keep the prices within the reach of those requiring a small, convenient, and safe power.

AGRICULTURAL INVENTIONS.

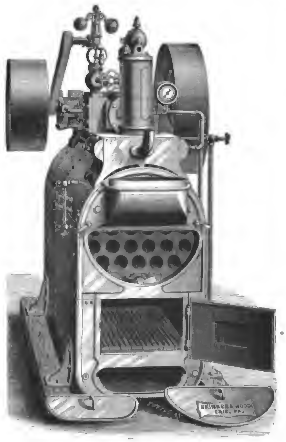
Mr. James H. Tanner, of Waco, Texas, has patented a combined planter and cultivator which is so constructed that the seed dropping appliances can be readily detached and the machine adjusted for use as a cultivator.

An improved fertilizer distributer, patented by Mr. Samuel H. Everett, of Macedon, N. Y., consists of a box in which a spoked wheel is revolved horizontally, by suitable mechanism, under a hinged adjustable shelf or cut-off and over a diagonally arranged opening in the bottom of the box, so that the delivery of the phosphates is made continuous and uniform by the passage of the spokes of the wheel over the diagonal opening.

Mr. Daniel Unthank, of Spiceland, Ind., has invented an improved two-horse cultivator, which is so constructed that the plows may be moved laterally and vertically without changing their pitch. It may be adjusted to give the plows any desired pitch to cause them to work deeper or shallower in the ground and to work closer or further from the rows of plants.

Mr. Richerson W. Spencer, of New Lexington P. O., Ala., has patented an improvement in that class of cultivators by which both sides of a row can be cultivated at the same time; and it consists of certain novel features which cannot be described without drawings.

Mr. Edward N. Griffith, of Irvington, N. J., has patented a spading fork adapted for use in any soil. It consists in a spading fork having tines as usual, and formed between the tines at the head with knife edges, whereby the fork may be used to cut grass, sod, or roots, or to take the place of a spade in addition to its ordinary use as fork.



PORTABLE ENGINE.—SIDE VIEW.

American Innovations.

The use of folding beds and cribs is becoming very fashionable in the United States. It is a question whether such beds would "take" in England, where the preference is given over wooden bedsteads to those of iron and brass, but in many other countries where it is customary to use the sleeping room as a day or living room, the folding bed, if known, would be a boon. Those known as the "Champion" automatic folding beds and cribs are really hand some articles of furniture, are easily manipulated, and of most simple construction. When open and ready for use they are most like an ordinary bed, and when closed or not in use they exhibit all the ornamentation and finish of a superior cabinet. Economy of space and appearance are not their only merits, for besides these advantages they are moderate in price. Another piece of furniture manufactured by the patentees of the "Champion" folding bed is a reservoir washstand in the form of a writing desk. When not in use this washstand has every appearance of a well finished and handsome desk, and is useful for that purpose. The washstand is a fit adjunct to the folding bed. The same company have some other novel and useful articles of house furniture which we may notice at another time.

Another description of folding beds, known as the "Burr," is designed to be serviceable for other than sleeping purposes. For instance, besides the ordinary cabinet bed, the "Burr" Company make the wardrobe bed, with a mirror 20 inches by 52 inches, the bookcase bed, with three drawers, three mirrors, and bookcase top; the buffet bed, with a sideboard top and shelves; and the desk bed, all of which are extremely elegant.

In designs for refrigerators American makes are fast leaving the beaten track. In all hot countries it has become a necessity to plan means for keeping articles of food in a fresh and cool state, and being themselves the inhabitants of a portion of the globe which is pretty hot in summer, the Americans have been compelled to combine experience with invention in this branch. Refrigerators are now in common household use in America, and they are not unknown on the railways, in the shape of specially constructed cars for the transport of produce, dead meat, fruit, etc. But we have to do at the present with small refrigerators for domestic use. These are the common chest refrigerators of the "Excelsior" pattern, suitable for the uses of a small household; the "Excelsior" and "Diamond" upright refrigerators with three or four shelves, the "Excelsior" double upright refrigerators of larger dimensions; beer refrigerators, and others too numerous to mention. With improved ice chambers, channels for the free current of air, etc., these refrigerators are now about as perfect as could be conceived. In South America, Australia, the Cape, and India, there ought to be an immense market for these goods.

The old fashioned three wheeled perambulator, which yielded *Punch* a rich harvest of jokes and cartoons, is not known in America; but, instead, the nursemaids and young mothers have the delight of driving out their charges in carriages of the most beautiful shape and finish. These baby carriages, the manufacture of which has become quite an industry in the States, are modeled upon the lines of the most exquisite Victorias or the neatest of broughams and phaetons. They are got up in the best possible manner, C and elliptic springs, electro-plated mountings, and the finest upholstery. All have four wheels, some with carriage tops, and others with adjustable sun shades. It is a pleasure to wheel these carriages, they are so light and handy, they satisfy the eye, and they give the young occupant ease and comfort. The baby carriage has been so largely adopted in the States that one seldom sees a child in arms now. Undoubtedly the very elegance and the comparative cheapness of these carriages will command a large demand for them out of the United States.

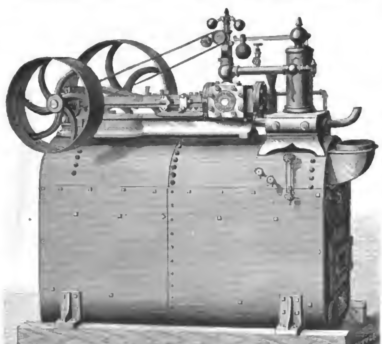
To write anything particularly new about the manufacture of boots and shoes by machinery would be difficult, because it must be pretty widely known that this trade has assumed enormous proportions in the Northeastern States.

So large has this industry become, it would not surprise many to learn that the home demand is too small for the production, and that the overplus must therefore find a market for itself in countries outside of North America.

These remarks, however, are beside our present intention; what we desire more especially to point out is the immense demand for steel shoe shanks or springs, for the making of boots and shoes. These shanks are cut by dies from sheet steel, into strips of about four and a half inches long and of various widths, which are placed on the instep between the leather. These give strength and elasticity to the shoe.

We know of three or four firms using in the aggregate about 1,500 tons of steel yearly in the manufacture of these shanks. Most of this steel comes from England.

We now refer to another kind of shoe—the horseshoe—and the very needful horseshoe nail. The rage for machinery in the States for all purposes, and the consequent education of the workmen up to the point of disliking the old form of manual labor, have made the introduction of machine-made horseshoes and nails an easy task. There are few blacksmiths now who do not prefer to use the ready-made article, which may be had of all shapes and sizes. Of course there is a saving in this, and the time



SKINNER & WOOD'S PORTABLE ENGINE.

will come when none other but the machine-made goods may be had. The manufacturers, some of whom are named, are said to be now exporting largely, and thus in foreign markets they are cultivating the American liking and preference for these goods. This is not to be wondered at, because the quality, the appearance, the fit, are all they ought to be to win and keep customers.—*British Trade Journal.*

NEW EGG TONGS.

The annexed engraving represents a neat and inexpensive egg tongs recently patented by Mr. R. P. H. Koska, of East Saginaw, Mich. It is one of those devices that is likely to come into general use, as it is as simple as anything well

KOSKA'S EGG TONGS.

could be for the purpose; it forms a handsome article of table furniture, and will be of great utility, as eggs are now generally eaten soft boiled. This device does away with the egg cup and with inconvenience in handling and breaking the egg, and it affords a simple means of holding the shell while its contents are eaten with an egg spoon, the egg shell forming the cup.

The construction of the device will be readily understood from the engraving. The concave receptacles at the end of the spring handle are of such shape and size as to inclose something more than half of an egg. Each cup carries a small spur, which pierces the shell and assists in holding it.

Further information concerning this invention may be obtained from Mr. R. P. H. Koska, Bancroft House, East Saginaw, Mich.

IMPROVED MEDICINE BOTTLE.

The accompanying engraving shows an improved medicine bottle designed to receive and support the spoon used in taking the medicine.

EARLE'S MEDICINE BOTTLE.

The bottle has upon one side a socket or cup of suitable size and shape to receive the greater portion of the spoon bowl, and near the top of the bottle there is a clip for holding the spoon handle. This device is the invention of Mr. J. H. Earle, of Fall River, Mass.

Engineers.—Their Value.

Under this heading the *Boston Journal of Commerce* comments on the engineer who solves problems—not the man, adds the editor, who opens the throttle valve of a locomotive that goes racing over the track from one city to another, or of him who sets in motion one of the Corliss monsters that drives its thousands of spindles and looms or other machinery—but the civil engineer, who lays out the work that employs the others, deals either in one or the other of two separate and distinct realms—absolute fact or supposition. In the first he is often made to doubt his own sagacity and capability, for he must often change his course of action by reason of deductions drawn from experiment in which all his ideas of strength, elasticity, or economy have strangely departed. If he deals in the second he becomes, as too many have done, egotistical, and by very lack of knowledge or through force of circumstances, is constantly taking up untenable positions, making expensive, unsatisfactory and unsuccessful experiments—in other words, father of failures. Too much of this has been and is done. In many cases the parties are sooner or later involved in an outlay of thousands of dollars, and then comes the legitimate outgrowth of an attempt at the impossible—disagreement, disappointment, law suits, bitter feeling, loss of time, money, production, loss to every one involved; and yet it is a matter of every-day occurrence, and one which would have been avoided by the employment of a competent engineer for a day or two at the cost of fifty or a hundred dollars. Men who know nothing of proportion, strength, elasticity, pressure, torsion, volume, or density, get out an idea and patent it, or advise it and get it introduced, and then users get the effect by adoption.

Engineers are not always consistent, we had almost said not honest. They deal sometimes in vagaries or in elements of uncertainty without careful consideration or consultation of authorities who have preceded them, and give opinions or make out tables or results from preconceived ideas of matters to which they never give an hour's consideration in an honest, careful way. In this way they have in a measure detracted from their usefulness and the respect due them. Such a one, however, is always found out sooner or later, and finds his level. A man to do his work in a successful way should be careful in all his statements, and if he does not know a thing for a *sure thing*, say so, and not assume one thing or the other, for it is in engineering as with law—common sense is a pretty sure guide, and will lead you right a thousand times where it leads you wrong once.

In dealing with earth, iron, water, steel, steam, or any of the natural elements or created forces, we must remember that we are only capable, at least, of an approximation; that we must reason and investigate—and if we live to the extreme allotment of life, we are still learners. The profession has in the last decade done much to attract the attention and merit the admiration of men who never think deeply, clearly, or upon forces or matter other than to see results that are the outcome of close reasoning. There is too much of the superficial, too little of the real; to progress we must look closely at all elements, simple or compound; and when we have learned our own insignificance, we have commenced building upon a "bed rock" that does not "heave or settle."

The Delaware Ship Canal.

The surveys of routes for the proposed Chesapeake and Delaware Ship Canal were completed in December last. Six routes have now been estimated for, as shown in the following table:

No.	Name.	Length in miles.	Length of canal proper.	Cost in millions of dollars.	Relative time of transit in hours.	Saving in distance in miles.
1	Choptank	149 81	37 67	16½	19⅛	175
1	Choptank (Inland	138 91	30 10	18⅛	19	166
2	Wye	129 42	42 89	26⅛	17⅜	191⅜
3	Queenstown	107 29	58 78	37⅛	17	217⅛
4	Centreville	106 38	50 95	41⅛	16⅛	219
5	Southeast Creek	115 78	38 33	23	15⅛	208⅛
6	Sassafras	129 25	16 30	8	15⅛	196⅜

The lengths given are respectively from Baltimore to a common point at sea, twelve miles outside of the Delaware breakwater. The distance from Baltimore by the route now used to the same point is 325 miles, or 33¼ hours, allowing a speed of 10 miles in open water and 8 miles in dredged canals.

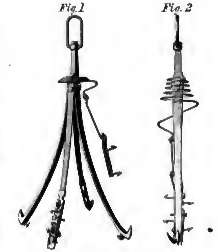
Mr. N. H. Hutton, under whom these surveys were made, reports that the Sassafras route is the shortest in time and the cheapest; but it has very expensive approaches to maintain and very serious conditions to be overcome if it is to be used during the winter. The Centreville and Queenstown routes are the most direct, rate second as to time, but cost largely in excess of other routes; have expensive approaches to maintain on the Chesapeake side, and are, as the Sassafras route, liable to obstruction by ice during the winter. The Choptank route rates slightly below the Sassafras as to time of transit, and rates third in this respect, while it is second on the list in point of cost, its greatest advantages being in the matters of freedom from obstruction by ice and economy of maintenance of approaches.

More recently Major W. P. Craighill, of the Engineer Corps, has made a new survey of the Sassafras route and estimates its cost at half a million dollars more than Mr. Hutton's estimate. Major Craighill's estimate is for a canal 100 feet wide on the bottom, 26 feet below low water, side slopes one and one-half to one, with a berme on one side 12 feet wide and 30 feet above the bottom.

The other estimates are for a canal 100 feet wide at the bottom, 26 feet below low water. The width is to be 178 feet at low water; the locks to have chambers 600 feet long and 60 feet wide; tide locks only to be built, and these will probably be generally open and only exceptionally used.

IMPROVED ANIMAL TRAP.

The annexed engraving represents a novel animal trap, recently patented by Mr. William J. Taber, of Lookout Station, Wyoming Ter. It is especially intended for catching bears, wolves, and other large animals, and it consists of four curved spring bars provided with hooks, and having a catch and trigger which hold them together when the trap is set, as shown in Fig. 2.



TABER'S ANIMAL TRAP.

Fig. 1 represents the trap after it is sprung. In setting the trap the outer ends of the spring bars are pressed together and held in place by the catch or trigger. The latter is engaged by a bait plate connected with the spiral spring at the top of the trap. The bait is attached to this plate, and when the animal seizes it, the trigger is disengaged and the curved bars spring outward, thrusting the hooks into the sides of the animal's mouth.

The inventor states that the barbs or points cut the mouth of the animal so that it soon bleeds to death.

IMPROVEMENT IN JUGS.

A stone jug is almost the last thing we would expect to see improved, and yet our engraving shows an improvement in this article which possesses the merit of being both simple and efficient. It consists of a passage or vent formed lengthwise in the handle, commencing inside the jug and terminating near the mouth of the jug. In filling the jug air is permitted to escape through this vent, thus allowing the liquid to enter the jug with greater rapidity than it

IMPROVED JUG.

otherwise would, and in pouring the contents from the jug, air enters the vent and fills the space as the liquid escapes.

This invention was recently patented by Mr. Samuel A. Conrad, of Terre Haute, Ind.

THIS has been a bad winter for fur dealers, sleigh makers, ice monopolists, and coal retailers in New York and vicinity.

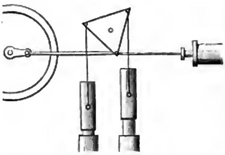
Correspondence.

Novel Pumping Engines.

To the Editor of the Scientific American:

The recently completed new water works of Pittsburg, Pa., include a series of pumping engines of novel design, and whose construction has cost that city $500,000, with an additional $260,000 in litigation. Their general plan and operations are so widely at variance with preconceived ideas as to what constitutes economical and effective pumping machinery, that engineers throughout the country generally denounce the Pittsburg engines as mechanical monstrosities. Their construction was begun several years ago, and as yet, owing to a succession of mishaps, they have not been taken off of the contractors' hands.

The inventor, Mr. Jos. Lowry—Mechanical Engineer to the city of Pittsburg—calls his invention the "graduating plunger" pumping engine. The Lowry engine resembles the Cornish pumper in having a walking beam which operates the pumps. In all other respects this engine differs from the Cornish. Each steam cylinder operates two equally



heavy plungers, and the momentum of a heavy flywheel aids in reaching the results attained. It is a horizontal engine, operating its flywheel on a level with its cylinder, but between cylinder and main shaft of the flywheel, about midway, are placed the novel features in the Lowry engine. These features in chief comprise a triangular, equal-sided walking beam, swinging on trunnions resting upon pillow blocks supported upon the bed plate, and 10 feet above the center line of the cylinder. This beam has a motion in a plane parallel to the vertical plane passing the center line named. This motion is taken directly from a pitman connecting the crosshead with the lower corner of the beam. To the upper two corners of the triangle are attached the pitmans leading downward to the pump plunger, which latter, with the pump barrels, air chambers, valve chamber, etc., are located directly beneath the walking beam and bed plate of the engine. To actuate the flywheel another pitman leads from the lower corner of the beam to the crank of the wheel shaft.

Regarding these features the inventor has this to say: "The great novelty in this engine consists in the manner of connecting the plungers and the steam piston, both piston and plungers being connected to a triangular walking beam and at an equal length of lever from the beam shaft or center, but at such angles that the following result is attained. When steam is admitted, and is at its maximum pressure, the steam piston is operating on the short lever of the beam, and the plunger is suspended on the longest arc of the same; and as the steam grows weaker by expansion the beam leverage increases, permitting a proportionate increase of speed by the piston. Meanwhile the corner of the beam connected with the pump plunger is shortened as to leverage. The result shows that, although the connecting points of both cylinder and plunger pitman are equidistant from the fulcrum, or center of the beam shaft, the steam piston travels 14 feet while the pump plungers travel 11 feet. But the great peculiarity of the engine is the continual varying of the relative speeds of steam piston and plungers. At the beginning of the stroke, when the steam is at its greatest pressure, the lowest plunger is lifted one-fifth faster than the travel of the steam piston actuating such plunger. At the end of the stroke, when the steam is weakened by expansion (cutting off at one-sixth the stroke), the steam piston is given leverage in proportion to this decreased force, permitting the piston to travel three times faster than the plunger. Again, on the descending stroke, the plungers first move slowly, traveling but one-third the rate of the piston, until, at the end of the stroke, it is traveling one-fifth faster."

This plan will be more clearly comprehended by inspecting the subjoined diagram, showing the principle only of the engine. The triangle, etc., are depicted in the position assumed at the beginning of the stroke, and when the crank of the main shaft is on the center nearest the cylinder. The valve chambers occupy the space just beneath the pumps and plungers, and the air chamber is located between the same.

As to labor performed, dimensions, etc., the following are the salient points: The water is taken from the Allegheny River and forced to the height of 356 feet into a reservoir 2,800 feet distant. To accomplish this requires the loading of each plunger to 220,000 pounds dead weight. The engines are four in number, coupled in pairs, each pair operating four such plungers as are described above. One pair is provided with compound cylinders, using the exhaust steam expansively. Their stroke is 14 feet, while that of the plungers is 11 feet 3 inches. Diameter of small cylinder, 64 inches; large, 106½ inches. Diameter pump barrels, 40 inches. The engines have been found to give best results when running at a speed of 8 revolutions per minute, though they have been worked all the way from 1 to 9½ revolutions in that time. Diameter flywheel, 32 feet; weight of each, 160,000 pounds. Estimated weight of the 4 engines and pumps, 5,000,000 pounds. In operation these great engines behave handsomely, working without apparent jar or strain. As to their actual duty no thorough test has as yet been made. The inventor states, however, that "in a partial test under many disadvantages, uncovered boilers and steam pipes, etc., the engine raised 4,682,000 gallons of water 356 feet high with the consumption of 300 bushels of coal, equal to a duty of 62,000,000 pounds raised 1 foot per 100 pounds coal used."

G. F. M.

Long Distance Telephoning.

To the Editor of the Scientific American:

Noticing an article in your issue of January 17, 1880, entitled "Long Distance Telephoning," I would like to say that nearly six months ago, in connection with the Western Union Managers of Marion, Fort Wayne, Ind., and Defiance, Ohio, I talked with as much ease and clearness as ordinary conversation is now carried on in this city and suburbs by the instruments mentioned in your article, the distance being 166 miles; after which Toledo, Ohio, was put in the circuit, making in all over 200 miles. The lines used were those of the Western Union Telegraph Company's, and as such subject to same conditions as are likely to be met with in nearly any part of the country. The instruments were the Edison carbon transmitter and the Phelps pony crown telephone as receiver, the same as now provided by the Gold and Stock Telegraph Company, of this city, no special adjustment or preparation being made. The future of long distance telephoning is *now waiting* at our doors.

LONG-LINES.

New York, January 16, 1880.

Railroading Reduced to a Science.

We are indebted for the following facts, says the *Railroad Journal*, to an official whose connections with the New York Central and Hudson River Railroad are such as to give him an intimate knowledge of the practical management of that property. From these it will be seen that railroading is fast being reduced to a practical science by Mr. Vanderbilt, as well as by Col. Scott, who was the first railroad president in this country, we believe, to employ scientific experts in the practical management of railroads. The series of experiments by which the results below enumerated were obtained and said facts demonstrated, were commenced under Commodore Vanderbilt, when he laid the two extra tracks, making the first four track road in the world the basis of these experiments.

Under the old two track system the New York Central with its heavy traffic had the maximum switching expenses, which is well understood among railroad men to be the greatest pertaining to the maintenance of a double track road. With four tracks this expense is reduced to the minimum, as well as that for maintaining the track and road bed. This is upon the recognized principle in railroading, that the most economically maintained and operated road is a single track road running only one train from one end of the road to the other and back without switching or switches. Every additional train running in opposite directions requires an additional switch, with additional expense for attendance and maintenance. Hence, the New York Central, with its 20 passenger and 30 freight trains daily, is run much cheaper on what is practically four single track roads, than formerly on its double tracks. There is now no switching or delay by switching and passing of trains from one end of the four tracks to the other, except to local freight trains which gather up and distribute all local freight between the larger stations without hinderance to the through trains which are run with the same engine from Buffalo to Albany or New York as the case may be, without stopping, except for fuel and water. Under the present system, adopted in 1875 or 1876, an engine is kept fired and running until it needs repairs, and not cooled off as formerly while the engineer slept. Now three sets of engineers and firemen are assigned to one engine for each 24 hours, or eight hours each. A locomotive is sent to the shops only once for repairs, it being found cheaper to sell and build new, than repair the second time. In this way the rolling stock of the road is idle (except for want of business) only when under repairs, and is never delayed by waiting for other trains to meet and pass, with the men who run them. It has been demonstrated also, that upon this road even, with its straight tracks, 15 miles per hour for a freight train is the most profitable speed, as above that the increase in wear and tear is greater than the saving in time.

As to the cost of attending and maintaining its tracks, the expense with four as compared with two tracks is as 1 to 8; that is, one man to 8 miles of track now against one man to 1 mile of track formerly. Thus, with more than double the capacity it is able to maintain and attend four tracks for one quarter the former cost of two tracks. This expense was formerly $750,000 per year, or $250,000 more than the present interest on the cost of the two extra tracks. The results upon the traffic of the New York Central for the first nine months after the opening of these extra tracks were that it hauled 75,000 more loaded freight cars and 750,000 tons more of freight than for the same time the preceding year, notwithstanding it included the period of the fierce railroad war of 1876 when there was a scarcity of freight for the trunk lines. It was also then asserted by the officers of the company that the road earned its 8 per cent dividends which were daily ascertained and set aside, to the dividend fund, notwithstanding what were then called "ruinously low rates of freight." From the foregoing it will be seen what a few years of scientific and practical experiment produced in economy of railroad management and also what may yet be done in the same direction.

The Avoidance of Fire Risk in Factories.

The art of constructing houses so as not to burn was described as follows by Mr. Edward Atkinson, in a recent address in Boston:

"The modern factory has no place in it, if we know it, where a rat can build a nest and not be found, or where fire cannot be reached by water. The factory properly consists of a brick wall, with the floor timbers 8 feet apart. These are about 6 inches by 12, and on them is laid 3 inch plank, and sometimes two thicknesses of tarred felt, and then the top floor. The whole construction is open; the spaces between the beams are wide, not narrow; water can be sent in great streams crosswise or lengthwise. The roof is built in the same way, nearly flat, so that whatever happens, there is a standing place upon it for the firemen. There is not a great mass of gables and cornices and concealed spots which modern architecture so many times requires, and which public opinion imposes upon architects, who know better. In the factory we don't allow any furrings or plaster on the walls. There is another thing which we never permit in the factory, but which, like iron shutters, is, I believe, required by the building law of Boston, that the timbers should be connected with the walls, so that when the beam burns off or is torn off, it brings the wall down. We have the beams laid on an iron plate, with their top corners arched off and the bricks immediately above them laid dry, so that if anything happens to those beams they roll out of their places and do not tear the wall down. But the great secret is cleanliness and order and the means of putting out small fires. When the secret is discovered how to make the interest of the assured and the interest of the underwriter identical, and to give the assured an interest in the success of the insurance company, as it is in the mutual company, then discipline may be enforced."

The practical economy of this sort of construction was shown by the following facts:

"Forty-five years ago the Hon. Zachariah Allen, of Rhode Island, having a cotton factory with some of the appliances that are now known to be effective, went to an underwriter of that day and asked that in consideration of those appliances the rate of insurance upon his factory should be reduced. The answer which he received was, 'Oh, we can't send our men around to look into all these little improvements that may amount to something and may not. The rate on cotton factories is 2 per cent, you may take it or leave it.' That induced Mr. Allen to found the system of the mutual insurance of factories, with a system of inspectors who did go around to look into these little appliances and see whether they made any difference in the risk or not. The result of that is a combination of companies, now insuring $200,000,000 a year, each insuring the other. The company of which I am president insured last year $43,000,000; it was a disastrous year in other lines; a year of excessive losses; we have lost less than $14,000. The mutual alliance of companies which Mr. Allen founded 40 years ago returned to their members this year on the 1st of January, on the risks then expiring, an average of 90 per cent of their premiums, and their average premiums on the mills which they insured, instead of being 2 per cent, is nine-tenths of 1 per cent; the sending around of a few young men to see whether these appliances were good for anything or not has reduced the cost of the insurance of those extra-hazardous properties to 9-100 of 1 per cent the past year. Compare that with the other method of insurance which is called stock insurance. Eighty-three New York companies, tabulated by the Superintendent of Insurance of New York, disclose the following facts: That their expenses had been 50 per cent of their premiums, and their losses 70 per cent."

THE ANTIQUITY OF THE SPOON.

The use of our common table utensil, the spoon, is widespread, and its invention, as it appears, dates from remote antiquity. The form which we use at the present day—a small oval bowl provided with a shank and flattened handle—is not that which has been universally adopted. If we examine into the manners and customs of some of the people less civilized than we—the Kabyles for example—we shall find that they use a round wooden spoon. The Romans also used a round spoon, which was made of copper. We might be led, from the latter fact, to infer that the primitive form of this utensil was round, and that the oval shape was a comparatively modern invention. But such is not the case; for M. Chantre, in making some excavations on the borders of Lake Paladru, the waters of which had been partially drawn off, found, in good state of preservation, wooden spoons which in shape were nearly like those in use at the present day; the only difference being in the form of the handle, which was no wider than the shank. The lacustrine station where these were found dates back to the ninth century, and we therefore have evidence that oval spoons were already in use during the Carlovingian epoch. The Neolithic peoples used oval spoons made of baked clay.

several fragments of such have been found in the Seine, and M. Perrault has also discovered a number in a Neolithic deposit in Burgundy. This gentleman found, in addition, a pot ladle. "The table spoons," says he, "are elongated and exactly resemble the wooden spoons in use in our kitchens. Their bowls vary from 8 to 14 mm. in depth." The portions of handles which he collected were too fragmentary to allow it to be determined whether or not they terminated in a flattened handle like the modern forms.

It might be pertinent to inquire to what possible use a spoon could have been put in the Reindeer Age, when raw meat was eaten, and when skin bottles were the only water vessels. Yet a genuine spoon made of reindeer's horn has been discovered in the Grotto of Gourdan. It is oval, very long, and quite shallow. Its handle is very elegant, being covered with engraved figures. Unfortunately it is broken so that it is impossible to say whether the handle was flattened. The slight depth of the spoon should not surprise us, for the men who made it knew neither soups nor sauces, and they could only have used it for the purpose of extracting the marrow from the long bones of large animals, or for eating the brains of the latter, and for such uses depth of bowl was of small consequence. M. Piette has likewise found other well characterized spoons in deposits of the Reindeer Age. One of these, more delicate, narrower, deeper, and less elegant than the one just mentioned, was found in one of the lowermost strata. At a still greater depth in the same deposit he came across a thick rudely made spoon, which appeared never to have had any handle. It was made of rough dressed bone, with polished edges, and its shape was oval. Before the invention of such an implement as a spoon, man of the Reindeer Age employed the spatula; and this is found at all depths in the Gourdan and Lortet deposits. M. Garrigan discovered in the Grotto of Alliat a fragment of reindeer's horn hollowed out in its whole length, and apparently designed for holding liquids; and similar utensils were found by M. Piette at Gourdan. These, however, were probably only temporarily used as spoons, the only genuine spoons which have been discovered being those described above, and which served as models for Neolithic man who afterwards appeared on the scene.

The Hudson River Tunnel.

The *Engineering News* says that in consequence of certain newspaper reports of a sensational style going the rounds, it has obtained the following information regarding the progress thus far made in the construction of the Hudson River Tunnel which is reliable.

A shaft 30 feet in diameter has been sunk in Jersey City, 80 feet west of the Hudson River, to a depth of 55 feet below mean high water.

A horizontal air lock has been placed in position, penetrating the side of the shaft, and the necessary machinery for compressing air has been provided and is now in good working order.

To ascertain as early as possible the effect of the air on the mud, the experiment was tried of driving a heading from the shaft, instead of commencing the tunnel in an open cut. The opening was made 25 feet below high water, the roof consisting of mud 10 feet in depth, underlying loose ash filling 18 feet in depth, the size of the excavation being 15 feet x 6 feet x 4 feet, and the air pressure applied amounting to 12 lb. per square inch. This pressure was kept on four days, during which time no air escaped through the mud. At the end of the second day, the surface of the mud which had been exposed to the air pressure became dry and began to crumble and crack open in places, and at the end of the fourth day these cracks had extended sufficiently through the mud to allow the air to commence to escape. Thereupon, the sides and roof of the opening began to give way, and twelve hours later the whole had fallen in.

The loose filling above was then removed to a depth of 9 feet below high water, the bottom of the trench covered with canvas and timber and the loose filling replaced. A new heading is now being driven in such a manner as not to allow any given surface of the mud to be exposed to air pressure for more than twenty-four hours.

Patent Bills Before Congress.

In alluding to the bills before Congress for changing the patent laws, to which we referred a few weeks ago, the *Milling World* in referring to Mr. Converse's bill, concludes that it appears to meet every possible requirement of those opposed to the granting of patents; but is it not a little singular, the editor adds, that such legislation should be attempted in face of the fact that the United States owes its remarkable growth and prosperity to the genius and skill of its inventors, more than to any other source? Take away the incentive (fortune and fame) from our inventors, and we shall soon lose them. It is a mistake to think an inventor can be nothing else than as inventor, and whether protected or not, that be will still invent. He is actuated by the same desires and aspirations as other men; he invents because in that way he thinks he can more quickly realize a competency (how often he fails is, alas! too well known); and the attempt at this time to wrest from him all protection should be frowned down by all who have the real interests of the country at heart. That certain modifications of our patent system can be judiciously made, with advantage alike to the inventor and the public, is no doubt true; but the *Milling World* would suggest the advisability of having such modifications presented by gentlemen of sufficient intellectual caliber to dispassionately consider the interests of both parties.

ON THE CRYSTALLIZATION OF CANADA BALSAM.

BY GEO. M. HOPKINS.

On reading Professor Barker's interesting paper on the crystallization of Canada balsam I was reminded of having observed a similar phenomenon long since. I did not then attribute it to crystallization, nor do I now think the beautiful arborescent forms are anything more than cohesion figures. There is before me at this moment an achromatic objective, the two lenses of which were separated some months ago by first warming them and then introducing between their edges the point of a knife; as the lenses began to separate the arborescent forms appeared, and were so like the forms shown in Fig. 1 (a reprint of Professor Barker's engraving) as to be at once recognized as the same thing. I have again separated the lenses, only partly, however, and there are figures having precisely the same characteristics as those shown in the cut.

FIG. 1.

This experiment may be readily repeated with two pieces of plate glass pressed together with an interposed film of Canada balsam. By separating the plates with a thin edge instrument the adhesion of the two surfaces is overcome, the balsam recedes, and air enters. Now this, I think, is precisely what happened to the objective referred to in Professor Barker's article. It was exposed to the action of the elements for three years, it probably became wet, then frozen. Some of the water entering between the edges of the flint and crown lenses, on freezing separated them, producing the arborescent forms. Upon the thawing of the ice the lenses approached each other, and in so doing inclosed a small quantity of air in the balsam. The next freezing separated the lenses and expanded the air spaces, giving them the beautiful forms shown in the engraving.

Of course it is not known how many times the lenses were separated and allowed to come together in the manner described; it is probable that the balsam after a time dried around the air spaces and thus fixed the arborescent forms.

I cannot leave this interesting subject without referring to a lantern slide, to which I applied this principle, and which forms one of the most beautiful objects that can be projected on a screen. Fig. 2 shows this device. The slide, which is fitted to the lantern, has a circular aperture for the passage of light, and is provided with two springs for holding two pieces of plate glass cemented together with Canada balsam.

Fig. 2.—LANTERN SLIDE FOR PROJECTING ARBORESCENT FORMS.

The upper and inner corners of the glass are beveled up to within a short distance of the ends, forming a groove or trough for the reception of an aqueous solution of some of the aniline colors. A lever carrying a pointed knife for separating the glasses is pivoted in the upper portion of the slide. At the ends of the glasses the two adjoining edges are beveled—as shown in the small detail view—to receive a portion of the surplus balsam pressed from between the glasses. This extra balsam prevents the entrance of air from the ends of the glasses.

The groove formed between the upper edges of the glasses being freed from balsam is filled by means of a pipette with a strong aqueous solution of one of the more brilliant aniline colors, and the slide is placed in the lantern. Now, by gradually pressing down the lever, the glasses are separated by the entrance of the knife between their edges. The arborescent forms grow downward in the slide, and the aniline color fills them, while upon the screen huge ferns and cacti grow up with great rapidity. Any of the brighter aniline colors will answer and look beautiful; but green seems the most appropriate, as the exquisite forms that appear on the screen resemble leaves and vegetation more than anything else.

Without the application of color the balsam yields images on the screen which closely resemble richly embossed white satin, the form of the figures being substantially like those shown in the engravings. Any viscid liquid will exhibit this phenomenon, but the balsam gives the best results.

What the New York Fair Should Be.

Discussing the favorable prospects for a World's Fair in this city in 1883, the *Tribune* makes a good point in saying that there should be no striving after mere magnitude, but rather an effort to compress the Exhibition into an area of moderate proportions by excluding advertising shows and crude and commonplace articles. The world is weary of colossal displays of objects that may be seen in the shop windows of every town. For a time it was curious to see what each nation produced, without regard to the quality and inherent merit of the articles themselves; but it got all the information it wanted in that direction at Vienna and Philadelphia and twice at Paris, and now it only cares to see the things that are most useful and most beautiful. Let us therefore have an Exhibition in New York that will surpass all its predecessors for real attractiveness and will not appal visitors by its enormous size. Let every square yard of its area contain something to please the eye or instruct the mind, and let the whole Fair be a condensed typical representation of the latest and best achievements of civilization.

The Mississippi River Survey.

The Mississippi River Commission report three triangulation parties, one topographical party, three observation parties, and one boring party in the field at work. These parties comprise a total working force of about 200 men, of whom about 20 are assistant engineers. The triangulation has covered a length of 125 miles between Cairo and Memphis. The topography has reached a little below Tiptonville, nearly ninety miles below Cairo. One of the observation parties is stationed at Fulton, Tenn.; another at Lake Providence, and another at Carrollton. The boring party is below Memphis at work.

NEW INVENTIONS.

Mr. Adelbert O. Müller, of Fremont, Neb., has patented a bushing that will protect the bung hole against charring during the operation of pitching the barrel, and which is also adapted to be tightened up as the stave shrinks, and thus prevent leakage. It consists in making the bushing in two parts, with an internal and external screw thread, to adapt them to be screwed together. The two parts are provided with flanges, which bear against the stave around the bung hole.

Mr. Henry Hartman, of Fort Douglas, Utah Territory, has patented an improvement in carbine holders, which consists of a metal spring clasp having straps attached thereto in such manner as to adapt them for attachment to the saddle.

An improvement in fan attachments has been patented by Mr. Walter M. Vestal, of Marcella Falls, Tenn. The object of this invention is to construct and arrange rods and levers by which motion can be given to a number of fans suspended over a table or elsewhere, for driving away flies and imparting an agreeable motion to the air.

Mr. Lemuel D. Dobbins, of Camden, N. J., has patented an improvement in apparatus for treating celluloid bases for artificial teeth. It consists of a top plate, from which the press and clamp are suspended by means of screw bolts, the plate resting on the upper edge of a cylindrical chamber. It consists in an improved press and clamp, arranged so that the clamp can be readily removed from the press for cooling.

Mr. Bernard T. Murphy, of Marengo, Iowa, has invented a durable and efficient device for hanging gates. It consists, essentially, of an adjustable roller hinge, by which the gate is attached to the gate post, and which admits of the vertical adjustment of the gate and its swinging in one direction laterally.

An improvement in tags has been patented by Mr. Clarence E. Sackett, of Garden Prairie, Ill. The invention consists in securing the wire to a tag in a novel manner, and so that it will not cut it, and so that the tag will lie flat and not turn edgewise when attached to an article.

Mr. James Robertson, of East Cambridge, Mass., has patented an improved system and apparatus for slaughtering animals for food, whereby the work may be done with great facility and economy.

NEW SYSTEM OF VENTILATION.

All natural methods of ventilation, and all mechanical means relying upon the wind to operate them, must necessarily fail at times, as in a calm, or with but a slight movement of the external air, they lose their motive power and fail to operate, and these failures usually occur at the very time when an active ventilation is most needed.

Those who advocate the use of ordinary fan blowers for ventilation, do not seem to get the full idea of the subject of ventilation and do not realize that a positive and constant circulation must be obtained to secure a perfect ventilation. Such a circulation, it is claimed, cannot be realized except by a system in which an *injection* of fresh air into the room and an *ejection* of the heated foul air from the room may be secured, with the ability of operating both at the same time and by the same power. The use of the blower during the summer (only injecting fresh air into the rooms) may create a tolerable circulation when the weather will admit of opening the windows and doors to allow the heated foul air to escape; but when, as in cold weather, the blower can be used only to send in heated air, and the windows and doors cannot be opened as in summer, there will be an accumulation of heated foul air until the atmosphere becomes oppressive, and then, to get a circulation, the windows are usually thrown open, and a draught of cold air is allowed to enter, to the discomfort and often to the injury of many.

The ventilating system, represented in the accompanying engraving, overcomes all of these difficulties and presents a simple means of thorough ventilation. The motive power is a steam air compressor, which furnishes a comparatively small supply of compressed air to the nozzle, in which the degree of compression is automatically regulated, so that whether larger or smaller quantities of air pass the nozzle, it cannot exceed or fall below certain limits of pressure, which have been determined by careful experiments as most economical in their results. The air ejected from the nozzle, with some *thirty or forty times its bulk of other air*, is carried through proper channels to the rooms to be ventilated.

The nozzle, A, is provided with a valve, B, having an elongated tapering portion, *b*, and a stem, *a*, furnished with a spring which is set or compressed to a given pressure. The valve is surrounded with a series of short radial ribs having grooves between them, which increase in depth toward the inner end of the valve. It will thus be seen that as the valve is pushed out by an increase of pressure, the volume of the escaping air jet is increased while its pressure remains the same.

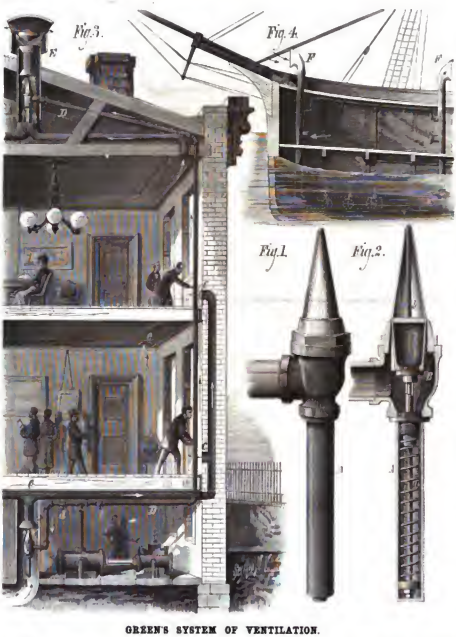
In Fig. 3, C is the fresh air supply pipe which discharges through openings, *c c*, into the apartments of the building. Below a funnel, connected with the pipe, C, an injecting nozzle, A is placed, and connected by a pipe, D, with a pressure air pump in the basement. The pipe, D, also extends to the ejector nozzle, A, in the ventilating shaft, E, at the top of the building, and the ventilating shaft communicates with registers in the ceilings of the different apartments. The air supplied by the direct acting air pressure pump being forced through the lower injecting nozzle, A, induces a flow of air from the air shaft into and through the pipe, C, to the apartments, and the ejecting nozzle, A, in the ventilating shaft, E, creates a strong upward draught, which draws the foul air from the apartments connected with the ventilating shaft. Fig. 3 shows the application of this system to the ventilation of steamships. For this service it is eminently adapted, as the air under pressure may be conveyed in small pipes, and the necessarily small, close apartments may not only be supplied with fresh air, but the foul air may be removed effectually. For steamships carrying cattle and perishable fruits, and to maintain a thorough circulation of air in the hold, it is especially adapted.

For the ventilation of public and private buildings, court houses, school houses, hospitals, public halls, hotels, banks, etc., and for any purpose requiring a complete circulation of air, this system seems very desirable. It has been indorsed by eminent engineers, and approved by many of our government officials.

The great advantages of this method are, that it is rendered entirely unnecessary to construct for ventilation wide air channels for the whole distance from the ventilating power to the place to be ventilated. This is absolutely necessary when fan wheels are used, or other contrivances propelling all the air used for ventilation, resulting in very little pressure and moderate velocity. By employing a very small amount of air, equal to two or three per cent of all of the air to be propelled, and giving it a high pressure and velocity, it may be conveyed in tubes of less than one tenth the diameter, thus reducing the size of the pipe from twenty inches to two inches.

This tubing may lead to the place to be ventilated, and there blow the air through the proper nozzle into the funnel-shaped opening, and the three per cent of compressed air will carry ninety-seven per cent of ordinary fresh air into a building as effectively as a fan wheel would carry it through a pipe ten times the diameter.

Further information regarding this system of ventilating may be obtained from the D. C. Green Ventilating Company, 88 Liberty street, New York city.



GREEN'S SYSTEM OF VENTILATION.

MISCELLANEOUS INVENTIONS.

Mr. Elisha Depue, of Silvara, Pa., has patented an improved tool for upsetting tires, carriage braces, and stays, iron rods, and other forgings. It is simple in construction, inexpensive, convenient, and effective.

Mr. Richard A. Kipling, of Roselle, N. J., has patented an electric lamp with carbons crossed so that they can be fed, by simple contrivances, directly against each other, point to point, in such a manner that the luminous arc will be formed around the carbon points where they meet, and shall cast no shadow below them.

An improvement in medicated belts has been patented by Messrs. William W. Vaughan and Joel J. Thom, of Brownsville, Mo. The object of this invention is to furnish a remedy and preventive of fever and ague. It consists in saturating hemp, jute, cotton, or other material, in rope form or otherwise, with tar, and inclosing it in a casing of cotton, linen, or the like, in the form of a belt, band, or strap, so that it may be conveniently secured around the body.

An improvement in combined washing and wringing machines, patented by Mr. Thomas J. Baldwin, of Pacific, Mo., consists of a box for receiving the clothes provided with a lid, which is secured by means of an eccentric bar and lever and rings, this box being supported between two standards and rotated by a crank, the shaft of which passes through one of the rollers of a clothes wringer, mounted on the frame of the machine, and provided with a lever for regulating the pressure. The box contains a number of wooden balls, which are thrown about during the revolutions of the box, and pound and wash the clothes.

An improved medicine spoon, invented by Mr. Barclay T. Trueblood, of Hadley, Ind., consists in a bowl provided with flanges, in combination with a cover fitting over the bowl and sliding under its flanges. With this spoon medicines can be easily and without waste administered to infants and others who resist their administration, and also to those who cannot be raised to an upright position.

An improvement in pressing irons, patented by Elvira A. Russell, of Minneapolis, Minn., is adapted to be placed over a lamp burner like a chimney, and, while serving the same purpose, be heated by the flame of the lamp. It consists in making the iron of the general form of a conical lamp chimney, having one of its exterior sides flattened to form an ironing surface, an extension at the smaller end on the flattened side to serve as a point for the iron, and at the large end a round portion to fit over the burner and hold the iron on the lamp top.

Mr. William H. Huston, of Chauncey, Ill., has patented a guard for doors or windows, formed of a number of sections composed of vertical and horizontal iron or steel bars, these sections hanging on L-shaped hooks in the casing of the door, in such a manner that no section can be removed unless the uppermost section is first removed.

Mr. George W. Ellis, of Philadelphia, Pa., has patented an improvement in the class of trusses for reducing hernia, in which the pad is attached to a slotted bar whose head is held in a clamp that allows adjustment of the pad in various positions.

Mr. William Wilmington, of Toledo, Ohio, has patented an improvement in chill moulds for casting car wheels, the object of which is to facilitate the moulding of car wheels and provide a suitable arrangement for the gas to escape, at the least cost, and without materially impairing the strength and durability of that class of car wheel chills that have in their construction an annular groove in the face of the flange portion of the chill to receive sand, or its equivalent, preparatory to casting the wheel. The reason for filling the groove with sand is to prolong the cooling of the outer portion of the flange of the wheel cast therein, thereby preventing the fracturing of the flange of the wheel which is incident to its rapid cooling and contraction.

Mr. Casper Marti, of New Albin, Iowa, has invented an improved trap for catching rats and other animals, which is simple in construction and convenient and effective. It is capable of catching the animal without leaving any trace or scent to frighten others that may come after him.

Mr. William Osmond, of New York city, has patented an improved device for attachment to the tops of fences, especially in back yards, to prevent cats from crossing or walking upon them, and thus prevent annoyance from the collection of cats by night in the yards.

ONE OF NATURE'S GLUTTONS.

BY DANIEL C. BEARD.

It was one sultry day last summer that I sent a messenger boy down on Fulton street to secure me a model for a picture I was to paint. After a short time the boy returned, bringing with him a most peculiar individual.

A pair of bright gem like eyes and a blunt nose, together with a broad, tightly-closed mouth, made up a countenance not easily to be forgotten; and his odd shaped head rested closely upon the shoulders. Add to this a pair of short arms terminating in hands of but four fingers each and disproportionately long legs, to which were attached very broad feet, and you have before you a picture of my model.

A musician by birth and occupation, he belongs to the genus *Rana*, known to naturalists as the *Rana pipens*, but to the schoolboy as the bullfrog! The particular batrachian whose portrait adorns this sheet is quite a favorite, in spite of his previous bad character. Although a tyrant and cannibal, he now numbers among his personal friends many well known artists and noted engravers, who gladly drop their brush, pencil, or graver for the pleasure of seeing the frog devour some crab, bug, or insect that has been captured for him. An old fish globe has been brought into requisition, and through its transparent wall the green prisoner now stares at me as I write. The frog had fasted in this crystal prison for over three weeks before it occurred to me that he might be hungry. To make amends for my neglect I spent almost half a day chasing blue-bottle flies around the room with but indifferent success. However, I captured twenty-five of them, and one vicious hornet that had strayed in through the open window. All these were successively swallowed by the frog in a most business like manner. A pink fleshy tongue would shoot out and in an instant the insect aimed at would disappear. When he came to the hornet the frog appeared to think his food was rather highly seasoned, for he winked his eyes several times, if that term can be applied to the act of sinking his eyes down in his head and then popping them up again.

Next day he ate fifteen large flies, two big lively katydids, and two full grown fiddler crabs, life-sized drawings of which may be seen upon the border to the accompanying illustration. He had for dessert the same day a dragon fly and an ichneumon fly. I have since tried him with raw meat, but he could not be pursuaded to touch it until a piece cut to represent some insect with long legs was put upon a straw and dangled in front of his nose; this he instantly snapped up.

Insects, crustaceans, mollusks, and small animals, anything with life and not too large to be taken into the capacious mouth of this animal, are greedily devoured, even its own tadpoles and young frogs form a palatable viand for the parent. Once I took a dead mouse and, holding it in the globe, jumped it around to give it the appearance of life. Without hesitation it was seized and speedily swallowed by the frog before he discovered that he had been swindled by a corpse. He then opened his mouth and with his fore feet deliberately pulled out the obnoxious mouse in a manner that set the spectators off in roars of laughter. Since then he has devoured many live mice with apparent relish, all of which he swallowed tail foremost, keeping up a lively kicking and scratching with fore and hind feet to prevent his prey from curling up and biting. Enough water is always kept in the globe to keep its inmate moist, but too shallow for a mouse to drown in. The wily batrachian is well aware of this fact, for it is not until nothing but the head and fore feet of the mouse protrude from between his jaws that he bends his head down, holding it and the mouse under water until the latter is suffocated before it is finally gulped down. Partly to make a more even fight and partly as an experiment to see what the frog would do under the circumstances, a little over a month ago, before putting in a large male mouse, we emptied all the water from the globe. Then ensued a chase; round and round went the mouse, trying in vain to scale the glassy walls, but never missing an opportunity to give the frog a savage nip with its sharp teeth. Round and round plunged the batrachian after him. Once he caught the mouse by the tail, whereupon the mouse turned and mounted the slimy back of his enemy and bit him severely; but quicker than thought the powerful hind leg of the frog swept the mouse from his back and dashed it violently against the side of the globe.

The battle had commenced and lasted about five minutes, when by a lucky snap the frog got the mouse by the hind quarters; the little mammal buried his sharp teeth in the frog's nose. Then again did the mill-pond croaker exhibit an intelligence and activity which I had always been led to believe these creatures never possessed. He kicked with his hind legs and pawed with his fore legs with such vigor that the rodent had very few opportunities of biting. Once the mouse's teeth fastened upon the hind foot of the frog, causing him to turn two or three complete somersaults in his efforts to free himself. The mouse was so large that it was no easy task for the *Rana pipens* to swallow him. Slowly but surely, however, he disappeared, until nothing but the head was visible. There being no water in the globe the frog could not drown him, so he did the next best thing—choked him to death by squeezing his neck until the poor rodent's bead-like eyes stuck out from its head, and life was extinct.

BULLFROG DISGORGING A MOUSE.

Scientific Gymnastics.

Exercise, to be beneficial in the highest sense, should be for itself alone; it must not be work in any sense; it should pursue its own objects, and no other; it should be made a pleasure and not a labor; it should be utterly divorced from ulterior notions of economizing expended powers; and this should never more firmly be insisted on than in the case of those abnormal creatures who say they take no pleasure except in useful work.

The theory of scientific gymnastics is directed to bring about three qualities in the tissues. 1. Responsiveness; 2. Endurance; 3. Strength. The first of these is displayed in suppleness or agility. The muscle is well under the control of the will; it responds at once, with promptness and to the required extent. The quick blow of the prize fighter, the exactly graded and lightning-like motion of the swordsman, are examples. Not only is the nervous message transmitted from the central organ to the muscle with the utmost rapidity, but the contraction of the muscle is just so much and no more than the designed effect demands for its accomplishment. This is what we mean by *responsiveness*.

Endurance is the capacity of repetition of the same act, the reiterated discharge of the same amount of nerve force to produce equal muscular contractions for an indefinite period. It is the "staying power" which the tissues must acquire in order to do their best work. It also means the learning and adoption of the line of least muscular force to perform a given task. This is slowly acquired, but when once known, allows of the performance of apparently most onerous tasks with little effort.

Strength is the third, and, beyond a certain moderate amount, least important end of athletic training, although it is often put first. The utmost strength that it is possible for any one to acquire is strictly limited by conditions of age, height, weight, and structure beyond the individual's control; nor is it at all necessary to develop the strength of muscles to their utmost in order to reach their utmost physical perfection. Quite the reverse, indeed, is the case.

To develop these three qualities of tissue wholly different methods of physical culture are required. They do not go hand in hand. The country lout with big muscles that can throw an ox has, as a rule, little endurance and less responsiveness. All army surgeons know how soon these big strong fellows will break down. The circus clown, agile as a cat, is often physically weak, and with no more endurance than an ordinary mortal.

Moreover, all three of these qualities are to be imparted to all the muscles of the body, in proportion to their uses, so that a symmetrical development may be secured. The blacksmith, with his mighty right arm, but who is "blown" in a foot race of a hundred yards, and the ballet dancer, with her legs like Diana's and her arms like stems, are familiar examples of the absence of symmetry.—*Medical and Surgical Reporter*.

The Benzoate of Sodium in Consumption and Diphtheria.

The inhalation of the benzoate of sodium in phthisis continues to attract attention in Germany. Prof. Rokitansky, of Innsprück, was the first to advocate it, and Dr. Winternitz and others who had visited his clinic report upon it very favorably. They aver that nearly all cases improve upon it, at least at first. This result is categorically denied by many other observers.

Its success as an agent in diphtheria is attested by Dr. Letzerich, of Berlin. The pseudo-membrane is dusted with powdered benzoate, applied through a glass tube or quill, two or three times a day. Older children may use a gargle of one part to twenty. The temperature and pulse together decline under this treatment. The pseudo-membrane contracts and becomes thinner and more transparent.

IT is estimated, by those in position to know, that more miles of railroad will be built during 1880 in this country than during any year before. About 9,000 miles of new road are already under contract.

THE ACTION OF LIGHT ON PLANTS.

The phenomena which the prolonged action of sunlight produces on vegetation in high latitudes are recorded by M. J. A. Broch in a work recently published.

The farther we go eastward from the Gulf Stream the more severe is the climate, even though the degree of latitude be the same. Thus Scandinavia and Finland possess an exceptionally mild climate, considering their high polar altitude. Indeed, barley and oats will ripen in the most northern districts of Norway, Sweden, and Finland, and immense forests are met with; while in Iceland, Greenland, and the polar confines of Russia and America, the earth is barren and sterile, and there are eternal snows. The cause of these advantageous climatic conditions is to be attributed to the enormous mass of warm water and hot air which the Gulf Stream brings down from the equatorial region to the coast of Norway, and which it approaches between 60° and 61° of latitude. This circumstance, together with the difference in the geological formation of the various northern countries of Europe, naturally lead to certain dissimilarities in the respective climates of these countries. The isothermal line passing through the places whose mean temperature is zero—skirting in Norway the chain of mountains and the sea coast from the North Cape, embracing also the central part of that country between the 60th and 63d parallels—begins in Finland at the 66th degree of latitude and rises rapidly to the north, forming a curve which incloses the elevated lands of the interior between the Gulf of Bothnia and the Arctic Sea, so that not only the countries situated south of that parallel, but also those which slope toward the Arctic Ocean and are submitted to the salutary influence of the Gulf Stream, have a mean temperature above zero. Of all the countries situated in the same latitude as Finland, the Scandinavian peninsula alone enjoys a milder climate. European Russia is much colder, and the climate of Asiatic Russia still severer. With regard to the action of prolonged solar light on the vegetation common to all those countries, Dr. Schübler, of the University of Christiana, has demonstrated that the seed of corn or other plants obtained from the northern regions ripens more quickly than that produced in the more southern countries. In the regions of the extreme north, where grain crops are uncertain in their yield, the seed corn of the north is always used in preference to any other. It is not less true that the various kinds of grain and vegetables cultivated in the northern regions yield better and are much richer in carbo-hydrates than the varieties cultivated more to the south. The color, moreover, is deeper—a phenomenon which applies also to all trees and plants. Foreign botanists visiting Norway and the other countries of the extreme north, in summer, are astonished at the fresh dark green of the foliage, and the bright colors of those flowers which grow both in northern and southern climes; and as this richness of color increases regularly with the latitude, trees and plants have at first been considered as new varieties. The leaves of trees grown in the north are larger even when the seed has been brought from more southern countries. M. Schübler has likewise proved that the aroma of all kinds of plants and fruits, both wild and cultivated, increases as the north is approached. Ordinary vegetables and herbs grown in high latitudes have a far more aromatic taste than those grown in southern countries. The caraway is an example of this fact; grown at Christiana, it contains 5·8 per cent of volatile oil, while that cultivated in Germany and Central Russia contains only from 4 to 4·8 per cent. But this large development of aromatic essence is not always considered an advantage; for instance, the tobacco plant grown in Norway or other northern countries contains, it is said, too much nicotine. In proportion, however, as the aroma increases with the latitude the saccharine substance diminishes; the berries and fruits of the north are less sweet than those which are cultivated or grown wild in the more southern parts of those countries. Consequently, while Norway, as well as Sweden, and even Finland, produces the most delicious apples, the pears are not sufficiently sweet. These facts, as well as the rapid growth of vegetation in the northern regions, are attributed to the prolonged action of solar light. Indeed, at Christiana, at the summer solstice, the sun remains below the horizon only 5 hours 17 minutes; at Trondhjem, 3 hours 34 minutes. At Bodöe, the chief town in Nordland, the sun does not descend below the horizon from June 3 to July 11; at Tromsöe, from May 20 to July 24; at Hammerfest, the chief town of Finmark, from May 15 to July 29. On the other hand, the center of the sun does not appear above the horizon at Bodöe from December 14 to December 28; at Tromsöe, from November 25 till January 16; and at Hammerfest, from November 20 to January 21. It is not surprising that barley, potatoes, and many other plants and vegetables ripen in the most northern latitudes, seeing that they are exposed to a considerable amount of heat during two or three months of the year. In those regions where the sun hardly descends below the horizon in summer, there is no night, only a short twilight; and the growing plant, therefore, enjoys permanently and without interruption the heat and light which it requires.

Mactear's Artificial Diamonds.

Some weeks ago an item was cabled from London to our daily newspapers stating that real sparkling diamonds had been artificially made by a Glasgow gentleman which withstood all the tests used in determining the natural stone. The *Journal of the Society of Arts* brings us the following facts concerning the alleged great discovery.

Professor Nevil Story Maskelyne, F.R.S., of the British Museum, has examined the presumed "diamonds" manufactured by Mr. James Mactear, of St. Rollox, Glasgow. The result of his examination is in a letter to the *Times*, from which the above *Journal* extracts:

"First, the diamond excels all substances in hardness. Secondly, its crystals belong to the cubic system, and should not, therefore, present the property of doubly refracting light. Frequently, however, from the influence of strain within the crystal, caused by inclosed gas bubbles or other causes, diamonds are not entirely without action on a ray of polarized light sent through them. Finally, the diamond is pure carbon, and as such, burns entirely away when heated to a sufficiently high temperature in the air, and more vividly so burns or glows away when heated in oxygen gas.

"The specimens I had to experiment upon were too light to possess appreciable weight, too small even to see unless by very good eyesight or with a lens, yet were, nevertheless, sufficiently large to answer the three questions suggested by the above properties.

"A few grains of the dust, for such the substance must be termed, were placed between a plate of topaz—a cleavage face, with its fine natural polish—and a polished surface of sapphire, and the two surfaces were carefully 'worked' over each other, with a view to the production of lines of abrasion from the particles between them. There was no abrasion. Ultimately the particles became bruised into a powder, but without scratching even the topaz. They were not diamond.

"Secondly, some particles, more crystalline in appearance than the rest, were mounted on a glass microscope slide, and examined in the microscope with polarized light. They acted each and all powerfully in the manner of a birefringent crystal. It seemed even in one or two of them that, when they lay on their broadest surface (it scarcely be called a 'crystal face'), a principal section of the crystal was just slightly inclined to a flattish side of it in a manner that suggested its not being a crystal of either of the ortho-symmetrical systems. Be that as it may, it was not a diamond.

"Finally, I took two of these microscopic particles and exposed them to the intense heat of a table blowpipe on a bit of platinum foil. They resisted this attempt to burn them. Then, for comparison, they were placed in contact with two little particles of diamond dust exceeding them in size, and the experiment was repeated. The result was that the diamond particles glowed and disappeared, while the little particles from Glasgow were as obstinate and unacted on as before. I had previously treated the specimen I have alluded to as the first on which I experimented by making a similar attempt in a hard glass tube in a stream of oxygen, and the result was the same. Hence I conclude that the substance supposed to be artificially formed diamond is not diamond and is not carbon; and I feel as confident in the results thus obtained from a few infinitesimal particles that can hardly be measured, and could only be weighed by an assay balance of the most refined delicacy, as if the experiments had been performed on crystals of appreciable size.

"Not content with merely proving what these crystalline particles are not, I made an experiment to determine something about what they are.

"Heated on platinum foil several times with ammonium fluoride they became visibly more minute, and a slight reddish-white incrustation was seen on the foil. At the suggestion of Dr. Flight, assistant in this department, a master in the craft of the chemical analyst, these little particles were left for the night in hydrofluoric acid in a platinum capsule. This morning they have disappeared, having become dissolved in the acid, and on evaporation there is seen a slight white incrustation, on the capsule, of the residuary fluoride. I have, therefore, no hesitation in declaring Mr. Mactear's 'diamonds,' not only not to be diamonds at all, but to consist of some crystallized silicate, possibly one resembling an augite, though it would be very rash to assert anything beyond the fact that they consist of a compound of silica, possibly of more than one such compound."

Mr. Maskelyne concludes that "the problem of the permutation of carbon, from its ordinary opaque black condition into that in which it occurs in nature as the limpid crystal of diamond, is still unsolved. That it will be solved no scientific mind can doubt, though the conditions necessary may prove to be very difficult to fulfill. It is possible that carbon, like metallic arsenic, passes directly into the condition of vapor from that of a solid, and that the condition for its sublimation in the form of crystals, or its cooling into crystal diamond from the liquid state, is one involving a combination of high temperature and high pressure present in the depths of the earth's crust, but very difficult to establish in a laboratory experiment."

THE INDUSTRIAL USES OF FISH SKINS.

Although the skin of fishes is chiefly gelatinous, and easily soluble in water, some are of a firm, strong texture and of a useful character. Up to within a few years, however, their employment for practical purposes has been rather limited, and it is only comparatively recently that attention has been more generally directed to their utilization on an extended scale. At a Maritime Exhibition held at the Westminster Aquarium in 1876, a Norway exhibitor showed a variety of tanned fish skins, among which were: tanned whale skins; upper leather made from the white fish; skins of flatfish prepared for gloves; skins of soles tanned and dressed for purses; skins of thornbacks prepared as a substitute for sandpaper; and skins of eels, dressed and dyed, suitable for braces, etc. Shoes have been made at Gloucester, Mass., from the skins of the cusk or tonk (*Brosmus vulgaris*), the use of which has been patented, and an industry is said to be carried on at Colborn, Canada, with the skins of species of siluroids for glove making. In Egypt, fish skins from the Red Sea are used for soles of shoes. The skin of the losh or burbot (*Lota maculata*) is used by the people in many parts of Russia and Siberia to trim their dresses. It is also utilized by some of the Tartar tribes, as material for their summer dresses, and the bags in which they pack their animal skins. The inhabitants of the eastern coasts of the middle of Asia clothe themselves with the tanned skin of the salmon. The spring and tuberculous skins of many sharks and allied fishes are largely employed, under various trade names, for polishing woods, and for covering boxes, cases, etc. From a certain portion of the skin of the angel shark (*Squatina angelus*) the Turks make the most beautiful sea-green watch cases. Turners, ebonists, and carpenters in Europe use the rough skin of the blue dog fish (*Squalus glaucus*) like emery paper, for smoothing their work and preparing it for polishing. This shark skin is also made into shagreen. That most used at present appears to be the skin of the ray (*Hypolophus sephen*), which is very common on the Malabar coast. The house of Giraudon, Paris, makes excellent use of them for morocco and *tabletterie*. At the recent Paris Exhibition, this establishment exhibited numerous illustrations of the ornamental application of the prepared skin in large office table inkstands, candlesticks, boxes and caskets, paper knives, reticules, card cases, photograph frames, bracelets, scent bottles, etc. The fish called *chat* (*Squalus catulus*) at Marseilles is smaller than the angel fish, and furnishes a product known as *peau de rousette*. This skin is reddish, and without spots, and of a uniform grain, flat, and only used to make cases and other articles known as shagreen. *Peau de chien de mer* is another name given to some species of *Squalus*. That found on the French coasts is known under the names of *chien marin*, *rousette tigrée*, etc. Turners, cabinet makers, and carpenters use the skin for scraping and smoothing their work, and it is also used for like purposes by metal workers. This skin, when worked up with the tubercles with which it is studded, takes the name of "galuchat," and is usually dyed green, to cover cases, sheaths, and boxes. Under the name of *chagrin*, these skins used to be much employed in Turkey, Syria, Tunis, and Tripoli; that made in Tripoli being considered the best. It was colored black, green, white, and red.

The Quinealt River Salmon.

The *Transcript*, of Olympia, Washington Territory, describes a new salmon which promises to make a valuable addition to our list of food fishes.

The Quineait River is situated midway between the mouth of the Columbia River and Cape Flattery, and empties into the Pacific Ocean, thirty-two miles north of Gray's Harbor. Salmon of one of the finest varieties visit this stream, and commence ascending the river about the 1st of March, and continue running up until the 1st of July. These fish are about 20 inches in length, 6 inches deep, and 3 inches thick, and weigh from 6 to 7 pounds each. They have very small fins and tails, and are very uniform in size and weight. Their color is a deep greenish blue on the back, with silver sides and white bellies. The meat is of a bright red color. They are extremely fat, and when put upon sticks before the fire to cook, as is the custom of the Indians, large quantities of fat drip from them. They are particularly noted for their rich and exceedingly fine flavor, and as far surpass the Columbia River Chinook silver-side as the latter does a dog salmon.

The Indians are very superstitious about them, and as all the catching grounds are on a reservation they have a monopoly of them. When they first commence to run it is impossible for a white man to get one for love or money, as the Indians believe it would stop the run. They are also superstitious about cutting them with a knife, and the first catch is always cut open by the old klootchmen with a sharp shell, and the heart of the salmon thrown into the fire and burned, for fear the salmon will be offended and not come into the river. Later in the season they cut them with knives and are glad to trade them to the whites. In May and June they run in endless numbers, and are as thick as herring in the sound, the water in the river at times being seemingly alive with them. The fish will not take either a fly or hook in any manner, and are only caught by the Indians in their primitive manner with weirs built across the stream, and made of poles and hazel brush. These weirs are built like all other weirs of the country, and are set at certain places in the river. The fish are taken out with dip nets, often from fifteen to twenty at a time. The weirs are made to stop all the fish ascending when fishing is going on, but are opened at other times to allow the fish to go up and spawn (a fact which white fishermen on other streams might heed to their advantage). It is supposed that they spawn in the river and do not ascend to the lake. Those engaged in propagating fish would do well to examine these salmon, as we are satisfied they would be a valuable addition to the varieties of fish now propagated by the United States Fish Commissioners and various State Commissioners. Coming early in the season, they could be put in the same streams with later salmon, and thus continue the fishing season nearly the whole year round. Their eggs can easily be obtained, and the trial, if successful, would be one of the greatest additions to fish culture ever undertaken.

Olives in California.

Mr. Edward Cooper, of Santa Barbara, California, has 6,000 olive trees, some of them seven years old, and these produce twenty gallons of berries each on an average in a good year, and one gallon of oil is obtained from seven of berries. Trees ten years old in a good soil will average fifty gallons of berries in a good year, but sometimes will yield 150 gallons. After a good crop the trees usually take a year's rest, so that its good years alternate. The oil yield from a mature orchard is estimated by the *Alta Californie* at 200 gallons of oil to the acre, and of this 50 gallons may be deducted to pay for gathering the berries and making and marketing the oil. Two gallons make a case of Mr. Cooper's bottles; though most of the imported bottles hold two ounces less. According to these figures an acre will yield $900 net annually, but, in the present depressed condition of business, a mature olive orchard would probably not sell for more than $400.

After visiting Europe and studying the olive question, Mr. Cooper believes that the California olive is unsurpassed in fitness for producing a fine table oil. The small purple berry is not so nice in appearance as the large green or whitish olive of Spain, but it is like the olives in those French districts which produce the best oils of Europe. Besides, he considers it excellent for pickling, and much prefers the pickled olives of Santa Barbara to those imported from Spain. A few of these Santa Barbara olives are in market; but are said not to be compared with the Kimball olives of San Diego. Olives like the last, if they could be had in abundance, would soon leave the Spanish article without a friend.

Many persons are preparing to set out olive orchards, and there is a great demand for cuttings, which are the only resource at present; but Mr. Cooper believes that the trees grown from the seed, and budded or grafted, though slower in bearing, will be stronger, healthier, and longer lived. He thinks the roots from the cutting never equal those from the seed in symmetry and vigor of nutrition. The Federal Department of Agriculture is cultivating twenty varieties of the European olive, and will soon be ready to supply applicants with cuttings.

MECHANICAL INVENTIONS.

Mr. James A. Robinson, of Nashville, Tenn., has patented an improvement in cylinder cocks, which consists in combining with a cylinder cock a thimble valve sliding on a stem, a loose pin passing through the stem, and a recessed rod fitted to slide in a cross mortise.

Mr. Harry Oscar Choles, of Upper Clapton, County of Middlesex, England, has patented an improved stock and die for screw threading pipes, etc. This invention has for its object, first, to prepare the pipe for the action of the screw cutting die by removing the burr, and also the hard outer surface of the pipe, this being done in advance of the screw cutting die, but at the same operation with the cutting of the screw thread, instead of at a previous operation, by means of a file, as usual; and, secondly, to feed the die along the pipe as it cuts the screw thread by means of a leading screw separate from the die, but combined with the die stock, instead of relying on the self-feeding action of the die, thereby relieving the die of this part of its work, facilitating the screw cutting operation, and insuring the formation of a perfectly true screw thread.

Mr. William Birch, of Salford, county of Lancaster, Great Britain, has patented an improved machine for guiding and stretching fabrics. The object of this invention is to make an improvement in the governor described in Patent No. 198,787, and to provide means for stretching fabrics in connection therewith. The inventor uses a well balanced frame pivoted in the central line of the passing fabric, and employs in conjunction with them rollers of suitable form.

Manganese Bronze Torpedo Boats.

Mr P. M. Parsons writes to the London *Times* with reference to the manganese bronze torpedo boat recently arrived at Portsmouth from the Thames. Mr. Parsons says that the thickness of the plates forming the skin of this boat was not 3-16 inch, but varied from No. 9 to No. 18 wire gauge, or from little more than ⅛ inch to about 1-16 inch. As regards the quivering spoken of, this only occurs when the engines are working at a certain number of revolutions, which are such as to make the pulsations of the propeller and the vibrations produced by the spring of the vessel isochronous, and this is also experienced in the steel boats when the speed is such that the two vibrations correspond. When this boat was going at the rate of 16 knots per hour, more than which speed she attained one day when Mr. Parsons was on board of her, no quivering or vibration was felt, but it set in when the speed was reduced to about 10 or 12 knots. He admits, however, that the manganese bronze plates supplied for this vessel are not quite so stiff as steel plates of the same thickness; but this occurred simply because in the contract no stipulation was made as to stiffness. The plates were supplied under the condition that they should stand the Admiralty test for steel plates, namely, a tensile strength of from 26 to 31 tons per square inch, with an elongation of not less than 20 per cent before breaking, and to bend cold to a radius twice the thickness of the plate. This test the plates stood perfectly, those taken haphazard and tested by the Admiralty Inspector giving between 29 and 30 tons breaking strain, with an elongation of from 25 to 35 per cent, and bending round cold to half the radius stipulated.

CHINESE PORCELAIN VASE.

The large porcelain vase shown on this page is of Chinese manufacture. The body, neck, and lips of the vase are covered for the most part with a fine vine and flower scroll pattern done in polychrome, but the front portion is occupied by medallions painted with figure subjects. What the subject of the upper design is, is uncertain, though it might very well represent a high official beset by rival office seekers. But the lower picture tells its own story. Here is a grand Mogul seated at his ease, surrounded by his courtiers, watching the performance of a couple of clowns. Standing on the steps, just outside of the Mogul's court, is the master of the clowns, urging the poor fellows on to renewed exertions, while on either hand, keeping him, the master, to his work, are two courtiers, one expostulating with him kindly, and the other standing silent, with drawn sword, and a most sinister look on his face—an action more potent than words.

CHINESE PORCELAIN VASE.

This picture is a very good illustration of Chinese pictorial art. It is full of character and action. It is not fine art, considered by our canons of good drawing and perspective, but it shows more artistic perception and ability to portray the salient points of a situation than many European artists possess.

Accident on Board the Greece.

Spontaneous combustion scores another victory over the ignorance of humanity. On Thursday last the steamer Greece arrived from Great Britain. As the cargoes this way are small or not sufficient to load the vessel entirely, the ocean steamers are bringing over sufficient coal to carry them back, either in whole or in part. In this instance there was a quantity of coal in the lower hold, and it was intended to transfer it from there to the bunkers. The coal must have been damp, and being hermetically sealed in the lowest depths of the ship's hold, there was no chance for ventilation, consequently sufficient carbonic oxide was there generated to cause an explosion upon the application of light. This was done when the men descended to the lower hold to unfasten the hatches. Five deaths have already resulted, and seven persons have suffered severe injuries. The *Coal Trade Review* thinks it is about time that vessel owners and captains became aware of the danger attached to the storage and carriage of this quality of coal (bituminous) in quantity, where it is liable to heating from any cause. Ventilating shafts at least should be made direct from the hold where stored to the outer air.

Phosphorescence in the Caribbean Sea.

Mr Alexander Agassiz, in his recent "Report on American Dredgings in the Caribbean Sea," states that in the roadstead, under the lee of the islands, there is little pelagic life to be found, and consequently the phosphorescence is far less brilliant than in the Gulf of Mexico. Yet occasionally the masses of *Ctenophora* (a species of *Mnemiopsis*) swimming at different depths, produce a very striking illumination; sudden flashes of light suddenly appearing as if coming from great balls of fire floating a short distance beneath the surface. The most striking phosphorescent phenomena were produced by a small annelid, allied to Syllis, which moved over the surface of the water with great rapidity, performing the most remarkable gyrations and tracing its path, which remained phosphorescent for a short time, by a brilliant line of light. Among the deep water forms several of the species of *Gorgonia* and *Antipathes* (especially *Rissa*) showed a bright bluish phosphorescence when coming up in the trawl. One ophiurian also, like one of the Mediterranean species mentioned by Panceri, was exceedingly phosphorescent, emitting along the whole length of its arms, at the joints, a brilliant bluish-green light.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR FEBRUARY, 1880.

Mercury.

On February 1 Mercury rises at 6h. 59m. A.M., and sets at 4h. 17m. P.M.

On February 29 Mercury rises at 7h. 11m. A.M., and sets at 6h. 50m. P.M.

In the latter part of February Mercury may be seen after sunset a few degrees north of the point of sunset.

On February 28 Mercury will be seen near Jupiter in the evening twilight.

Venus.

Venus will be brilliant in the morning throughout the month of February, although rising later and coming more nearly into daylight.

On February 1 Venus rises at 4h. 49m. A.M., on February 29 at 5h. 9m. A.M.

On the morning of February 7 Venus will be seen in conjunction with the thin crescent moon; Venus is about 2° north of the moon in declination.

Mars.

Mars will be the most conspicuous of the evening planets. Its great declination gives it a very high altitude at meridian passage; on February 29 its altitude in this latitude is nearly 72°.

On February 1 Mars rises at 11h. 21m. A.M., and comes to meridian at 6h. 40m. P.M., at an altitude of 69°.

On February 29 Mars rises at 10h. 14m. A.M., and sets at 1h. 16m. of the next morning.

Mars will be seen to be among the bright stars of Taurus; on February 9 it will be 2° south of the star Eta Tauri.

The moon will be seen to approach Mars on the evening of February 17.

Jupiter.

On February 1 Jupiter rises at 8h. 47m. A.M. and sets at 7h. 59m. P.M.

On February 29 Jupiter sets at 6h. 42m. P.M.

Jupiter is two nearly in the direction of the sun for good observations.

Saturn.

Saturn as well as Jupiter sets early in February, and it is getting so far off that even large telescopes will not show the smallest satellites.

Saturn sets on February 1 at 10h. 7m. P.M., and on February 29 at 8h. 31m. P.M.

Uranus.

Uranus is in its best position during February.

On February 1 Uranus rises at 7h. 19m., and sets at 8h. 26m. of the next morning.

On February 29 Uranus rises at 5h. 22m. P.M., and sets at 6h. 33m. of the next day.

Uranus is moving away from Lambda Leonis toward Rho Leonis, and on February 29 it has nearly the declination of this star and follows it in right ascension.

A glass of two inches aperture will show the disk of Uranus.

Neptune.

On February 1 Neptune rises at 10h. 57m. A.M., and sets at 12h. 31m. A.M., of the next day.

On February 29 Neptune rises at 9h. 8m. A.M., and sets at 10h. 43m. P.M.

Neptune is among the small stars of Aries.

Occultations.

The "American Nautical Almanac" gives the Washington time, February 16, 11h. 30m. P.M. for the disappearance of Epsilon Arietis, a multiple star, by occultation, or by the moon's passing across it. As the moon will not have reached the first quarter the stars will seem to touch the dark limb and disappear at once; this is always an interesting phenomenon to observe, and is valuable for a determination of longitude. With an ordinary telescope the stars will appear as one.

Sun Spots.

The spots on the sun have been very few for several years. At this time (January 15) two large spots are passing out of sight, in consequence of the motion of the sun on its axis, and a group of some 18 or 20 small ones has made more than half its passage across. These will probably be seen again in February. The large ones should be easily seen somewhat advanced upon the disk on the first day of February.

RECENT DECISIONS RELATING TO PATENTS, ASSIGNMENTS, ETC.

THE RIGHTS OF ASSIGNEES IN PATENTS.

It frequently happens that an inventor, in order to supply himself with the means to apply for a patent or introduce his invention, agrees with another person that, in consideration of the advance of funds, he will grant an assignment of the invention and of the letters patent therefor, in a certain State or States. The making of such assignments in advance of the issue of the patent is quite common; and when the patent is granted the assignee is the owner of the patent without further transfer, for the district originally conveyed to him.

There have been cases where the inventor has attempted to deprive his assignee of the benefits of the original assignment by dodges like the following: The inventor applies for the patent, and it is officially rejected. His assignee is informed that no patent can be obtained, and the matter is supposed to be closed. But on a subsequent occasion the inventor, having made changes in the invention, files an entirely new application. At last a patent is granted, but the inventor declines to admit the original assignee to any benefits therefrom on the ground that the patent is not for the application on which the advances were based.

The question whether the assignee has any right in such patent has been very forcibly decided in favor of the assignee by the U. S. Supreme Court in the well known coal-burner stove case.

An assignment of April 5, 1853, recites the granting to Littlefield of a patent on the 15th of April, 1851, "for a coal burner so constructed as to produce combustion of the inflammable gases of anthracite coal," and the fact that he had applied for a patent "securing to him a certain improvement in the invention so as aforesaid patented by him," and then assigns to Treadwell and Perry all the right, title, and interest which Littlefield "now has, or can or may hereafter have, in or to the aforesaid inventions, improvement, and patent, or the patent or patents that may be granted for said inventions or any improvements thereon, and in any extension or extensions thereof, within and throughout the district and territory embraced within the States of New York and Connecticut, for and during the term for which the aforesaid letters patent were granted, and the terms for which any patent for the aforesaid improvement, and any other improvement or improvements thereof, or extensions for or of either thereof, may be granted." The Supreme Court of the United States, in Littlefield *versus* Perry (21 Wallace, 205), held that this assignment, "taken by itself, contains, in most unmistakable language, an absolute conveyance by the patentee of his patent and inventions described, and all improvements thereon, within and throughout the States of New York and Connecticut," and that this assignment and a supplemental agreement executed between the same parties at the same time, when construed together, operated to constitute Treadwell and Perry the assignees of Littlefield within the patent laws in respect to the subject matter of the assignment, and to give them and those claiming under them the right to sue in this Court to prevent any infringement upon their rights.

On the 22d of July, 1853, Littlefield withdrew the application before mentioned, which had been filed December 30, 1852, and filed a new application, on which a patent was issued to him January 24, 1854. The Supreme Court held, in the case referred to, that the assignees became in equity the owners of this patent of 1854 under the assignment of April, 1853; that all the patents outstanding and the subject of the controversy in that suit, exclusive of the patent of 1851, were either reissues of the patent of 1854 or improvements upon it; and that the use of the said patents issued after January, 1854, by Littlefield and his co-defendant, Jagger, was an infringement of the rights of said assignees. The patents so referred to were these: A patent issued June 25, 1861: reissues, in two parts, 132 and 133, made November 19, 1861, of the patent of January 24, 1854; reissues, in four parts, 1,332, 1,333, 1,334, and 1,335, made August 26, 1862, of the patent of January 24, 1854, on the surrender of reissues 132 and 133; reissues, in two parts, 1,426 and 1,427, made March 3, 1863, of the patent of January 24, 1854, on the surrender of two of the four reissues of August 26, 1862; reissues, in two parts, 1,478 and 1,479, made May 19, 1863, of the patent of January 24, 1854, on the surrender of the remaining two of the four reissues of August 26, 1862; reissues, in two parts, 1,813 and 1,814, made November 8, 1864, of the patent of January 24, 1854, on the surrender of reissues 1,426 and 1,427; reissue 1,815, made November 8, 1864, of the patent of January 24, 1854, on the surrender of one of the two reissues of May 19, 1863; reissue 1,823, made November 22, 1864, of the patent of January 24, 1854, on the surrender of the remaining one of the two reissues of May 19, 1863; a patent issued December 19, 1862; a patent issued August 18, 1863; and reissue 1,594, made December 22, 1863, of the patent of August 18, 1863. The outstanding patents, when the bill of revivor and supplement was filed by John S. Perry, trustee, etc., against Littlefield and Jagger, on the 6th of February, 1865, were (exclusive of the patent of 1851), the patent of June 25, 1861, the patent of December 9, 1862, reissues 1,813, 1,814, 1,815, and 1,823 of the patent of January 24, 1854, and reissue 1,594 of the patent of August 18, 1863.

A new suit, brought by Perry against Littlefield, to recover ownership and damages in some other patents, additional to those named above, has just been decided in favor of the assignees by Judge Blatchford, in the U. S. Circuit Court in the Northern District of New York.

U. S. Circuit Court—Eastern District of New York.—Benedict, J.

BLACKMAN *et al. versus* HIBBLER *et al.*—GLASS BASE FOR COAL OIL LAMPS.

1. The invention embraced in patent to E. Blackman, February 6, 1872, No. 123,335, is a lamp chimney with the top or upper portion constructed of mica, and a glass base, the two being united and designed to be used together as a unit, and the reissue No. 7,417, December 5, 1876, describing and claiming the base separately, is invalid, as being for a different invention.

2. When the original patent described a certain form of mica chimney united to a glass base, a reissue claiming such glass base in combination with any form of chimney top was regarded as greatly enlarging the scope of the invention by dropping one element from the combination and putting in its place another, not its equivalent.

3. A lamp chimney constructed with base and top in one piece being old, no invention was required to conceive the idea that it could be made in two pieces, nor to form a surrounding rim upon the upper part of the base for the purpose of maintaining in position the separate top piece.

Bill dismissed for lack of novelty in the invention.

U.S. Circuit Court.—Eastern District of Pennsylvania.—McKennan, J.

LORILLARD *et al. versus* RIDGEWAY.—THE MARKING OF PLUG TOBACCO BY PRESSURE NOT A PATENTABLE INVENTION.

1. Tobacco having been marked by pressing into its surface metallic or other hard substances, the imprint of which was left upon the tobacco, it was no invention to provide such plates with prongs or projections, and allow them to remain upon the tobacco.

2. Letters and other distinguishing marks having been produced upon tobacco, to put such marks upon a metallic tag, if greater prominence was desired, was readily suggested to the common mind, and did not rise to the dignity of an invention.

Before the Commissioner of Patents.—Paine, Commissioner.

VEGETABLE-LIFE DESTROYER.

The motion is submitted in the following words:

In the application for patent for vegetable sprout killer by Francis B. Rodgers, filed January 2, 1878, the decision of the Examiner denying the patent has been overruled by the Board of Appeals. Applicant requests the allowance of the patent by the Examiner (unless the utility of the patent is denied) in accordance with the decision of the Examiners-in-Chief.

The application relates to a compound or mixture for the destruction of vegetable life.

One of the grounds upon which the Examiner rejected the application was that the mixture was a mere aggregation having no functions differing from those of its several ingredients. The applicant insisted that the compound operated more rapidly and effectually than either of its elements. The Examiners-in-Chief decided, on appeal, that if the mixture described operated more effectually and rapidly, and was more convenient in use, than its elements, the applicant was entitled to a monopoly of his new compound; but in their decision they stated that they were not informed on this point, and suggested that the applicant should be permitted to file affidavits, under Rule 31, in case the examiner should traverse his assertion that the mixture operated as *above stated*. Thereupon the applicant requested the allowance of the patent by the Examiner (unless the utility of the patent was denied), in accordance with the decision of the Examiners-in-Chief.

The examiner replied that he did not deny the usefulness or operativeness of the mixture, but denied its patentability.

The applicant appealed to the Commissioner because, as he alleged, the Examiner ignored the decision of the Examiners-in-Chief; and he asked that the Examiner might be instructed to act in accordance with that decision.

The Commissioner held that, inasmuch as the Examiners-in-Chief had decided that if the mixture was operative, as claimed, it was patentable in favor of the applicant, although they had not decided whether it was or was not so operative, their decision was obligatory upon the Primary Examiner, and that it was therefore the duty of the Primary Examiner, if he did not deny that the compound operated as the applicant claimed, to pass the case to issue. Thereupon the applicant requested that the Primary Examiner, inasmuch as he did not deny the operativeness of the invention, should, in obedience to the decision of the Commissioner, pass the case to issue without further delay.

The examiner replied that the Commissioner's decision was that he should pass the case to issue if he did not deny that the mixture operated more effectually and rapidly than any of its elements; and that, while he did not deny the operativeness of the mixture, he did deny that it acted more effectually than its component parts. And he added that, while the suggestion of the Examiners-in-Chief that the applicant should be permitted to submit affidavits would have been consistent with the rules if the Examiner had denied the operativeness or usefulness of the compound, nevertheless, inasmuch as he did not deny its operativeness or usefulness, but only denied that it would act more effectually or rapidly or conveniently than any of its elements, affidavits were expressly prohibited by the last clause of Rule 31, in which it is provided that "affidavits in support of applications will not be received at any stage of the examination unless the office denies that the invention is operative or useful." Upon this action of the Examiner the present motion for the transfer of the case to another division is based.

This motion cannot be granted. The Primary Examiner has not disregarded the decision of the Commissioner, nor has he disobeyed the decision of the Board of Examiners-in-Chief; and, while he has declined to comply with their suggestion that applicant should be permitted to submit affidavits in the case, he has done so in the belief that this course was forbidden by the rules of the office. I am not prepared to say that this impression was incorrect.

But I see no good why the applicant should not be permitted, if he can do so, to show that this mixture acts more rapidly and more effectually than the elements of which it is composed, and is more conveniently used. I think that, under Section 483 of the Revised Statutes, I have authority by an order made with the approval of the Secretary to authorize him to introduce such affidavits.

It is accordingly ordered that the applicant be permitted, within sixty days after the date of this order, to submit affidavits for the purpose of showing that his compound or mixture operates more effectually or rapidly and is more convenient in use than any of the substances of which it is compounded.

The relief demanded by the applicant is denied.

[Approved by the Secretary.]

An undue zeal for the observance of forms and ceremonies is apt to make the ablest officials lose sight of the main object for which they are individually housed in the Patent Office, and for which the patent laws were enacted, to wit: *the promotion of the useful arts by the grant of patents to authors and inventors.* In times past some of the Commissioners and some examiners seemed to labor under the mistaken notion that the chief purpose of their official life was the opposing of inventors, the placing of obstacles in their way, and preventing the grant of patents.

The foregoing case illustrates our meaning: The Examiner in the first place appears to have wrongfully denied the patent. The applicant was then put to the expense of an appeal to the Board of Examiners, who practically decided that a patent should be granted. But the Examiner then holds back the patent on a technicality; the applicant is then put to the further expense of appealing to the Commissioner in person, who supports the little point raised; which now subjects the inventor to further delays and costs in getting up expert testimony. All the trouble to all the parties concerned would have been avoided had the Examiner in the first instance simply issued the patent.

We doubt whether there is any instance where a Patent Office mistake made in favor of the inventor ever hurt the Examiner, the Commissioner, the Secretary of the Interior, or any other official. On the other hand such wrangles as the foregoing are always unprofitable, and do them little credit.

Yankee Inquisitiveness.

The *Price Current*, Portland, Me., suggests a legitimate and wise plan to increase the demand for the products and manufactures of any and every country. When a man has a really valuable article to offer to the world, he should devise the best ways and means to let the buyer and consumer know the source from whence it came, and, if possible, the means and expense by which the recipient may obtain more of the same kind. The result of this justifiable inquisitiveness will be the doubling of the crop of good apples in Maine within a few years. L. J. Stout, of Limington, Me., while barreling apples to be shipped to parts entirely unknown to him, conceived the novel idea of ascertaining their destination by putting a letter, inclosing money to pay the postage on a letter, in one of the barrels, kindly asking the purchaser to write him the date of opening it, his name and residence, the price paid, the condition of the apples when opened, etc. In about three months Mr. Stout received a letter from a merchant in London, England, saying one of his customers found the letter and passed it to him, and by him it was neatly answered, giving all the desired information in regard to the apples, etc. Last winter Mr. Stout received a letter from the same merchant in relation to filling an order for Maine apples, but the quality and scarcity of the fruit last year prevented his filling the order satisfactorily to himself. Last week Mr. Stout received another order by cable for several hundred barrels as samples, from the same person. As Mr. Stout will undoubtedly fill the order, the English gentleman will no doubt be surprised at the size and quality of the fruit—which is this year probably a third larger than two years ago.

The Metric System.

It may not be generally known that we have, in the nickel five cent piece of our coinage, a key to the tables of linear measures and of weights. The diameter of this coin is 2 *centimeters*, and its weight is 5 *grammes*. Five of them placed in a row will, of course, give the length of the *decimeter;* and two of them will weigh a *decagramme*. As the *kiloliter* is a *cubic meter*, the key to the measure of length is also the key to measures of capacity. Any person, therefore, who is fortunate enough to own a five cent nickel may carry in his pocket the entire metric system of weights and measures.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

---

(1) J. writes: I have a boiler that is good with the exception of about 4 inches at bottom of leg that is eaten badly by salt deposit. I have an idea of raising grate bars and filling with a cement of some kind. Can you inform me how to make it? A. Hydraulic cement, properly mixed, may answer your purpose.

(2) C. F. L. asks how tracing or vellum cloth is made. A. Wagner's tracing cloth is said to be prepared as follows: Boiled bleached linseed oil, 20 lb.; lead shavings, 1 lb.; zinc oxide, 5 lb.; Venetian turpentine, ½ lb.; boil for several hours, then strain, and dissolve in the strained composition 5 lb. white gum copal. Remove from the fire, and when partly cooled add purified oil of turpine sufficient to bring to the proper consistence. Moisten the cloth thoroughly in benzole, and then give it a flowing coat of the varnish.

(3) G. writes: If a 10 lb weight is dropped from the center mast head of a steamer running 16 knots per hour, what position would the steamer bear to the weight on its reaching the water? A claims that the time occupied by the falling of the weight will cause the steamer to be in advance of the weight's original position at the mast head to the steamer's center, said advance to be computed by the length of steamer and rate of her progress, due allowance being made for force of wind. B claims the weight will fall directly perpendicular, and when touching the water will be in its original position, due allowance being made for the force of wind. A. Neither is exactly right; the weight will strike the deck a very little aft of the perpendicular, as the vessel maintains a constant speed, whereas the weight has the speed of the vessel before dropping, but loses a very small fraction of that speed during the time of falling.

(4) C. M. K. asks: What will destroy or drive away fleas? A. Try pennyroyal or essence of pennyroyal.

(5) D. S. K. asks for directions for silver plating iron and steel. A. Dissolve 12 ounces cyanide of potassium and 1 ounce (troy) of chloride of silver in 1 gallon soft water; filter, and suspend in this bath the chemically clean work and a plate of pure silver, exposing a surface somewhat larger than that of the work. Connect the work with the negative or zinc pole of a small Daniell or Smee battery of two or three cells by means of a stout copper wire, and join the silver plate in a similar manner with the positive pole of the battery. The work may be prepared for the bath by boiling it in a strong aqueous solution of caustic potassa or soda to remove traces of oil, rinsing in running water and scouring with a brush and pumice powder moistened with strong cyanide of potassium solution; then quickly rinsing again, and, without fingering, placing in the bath, and in circuit. A somewhat weaker (in silver) bath, called the "whitening" bath, and a stronger battery, is generally used to whiten or throw on the first film of silver. The proportions for this are: cyanide of potassium, 1 lb.; chloride of silver, ¼ ounce (troy). If the silver runs on dark, use a weaker battery, or break the current so as to give alternate intervals of rest. 30 minutes ordinarily suffices when a battery of 3 or 4 Smee cells, plates 10x4 inches, are used. In the whitening process an additional cell or more is employed. Iron takes silver better after having received a light deposit of copper. The metal must be freed from oxide by pickling in dilute acid and scouring with sand. For coppering a slightly acid bath of the sulphate and a strong battery may be used.

(6) "Reader" asks: Has chromic acid much application in the arts, where manufactured, and what its probable price? A. Yes, several of our large Philadelphia houses now produce the acid. It is quoted at 20 cents per ounce. 2. Can muriatic acid gas be made to combine with turpentine by the aid of heat, or at ordinary temperature without aid of a freezing mixture? A. Turpentine oil forms several compounds with hydrochloric acid. The gaseous acid converts it into the monohydrochloride, $C_{10}H_{16}.HCl$; when the oil is subjected for several weeks to the action of the strong aqueous acid, crystals of the dihydrochloride $C_{10}H_{16}.2HCl$ are obtained. The latter compound is also formed by the action of hydrochloric acid on lemon oil; hence it is called citrene dihydrochloride.

(7) H. H. K. asks how to clean and crystallize the blue vitriol which is found in the bottom of dip jars. A. Dissolve in small quantity of hot water, cool slowly, and evaporate by exposure to the air.

(8) F. W. D. writes: 1. Will you please inform an amateur photographer of the easiest way to recover the silver from waste solutions. 2. If it harms or benefits the silver bath to leave it in the sunlight? A. 1. Precipitate the warm solution by addition to it of common salt; allow it to settle, decant the clear liquid, and throw the precipitate, together with several scraps of zinc, into warm dilute sulphuric acid. When the chloride is all reduced, pick out the remainder of the zinc, decant and press out the liquid from the precipitate, dry, mix it with a little borax, glass, and powdered resin in a small clay crucible, and heat to complete fusion. Cool and break the crucible; the silver will be found as a button in the bottom. With a small crucible, a good fire in an ordinary cooking stove will answer for the fusion. 2. If covered, it is beneficial.

(9) A. R. F. asks: Can I get any more power from an undershot water wheel fitted with appliances to keep the paddles vertical than I can with a common stayed undershot of the same dimensions? If so, how much? A. You can, if the arrangements are suitable to the course of the current. The amount of gain will depend very much upon such arrangements.

(10) C. R. B. asks how to tin iron castings. A. Small articles of cast iron may be tinned by wrapping them loosely with zinc wire and immersing in a solution of perchloride of tin in 10 parts of soft water for 15 minutes. The castings must of course be well cleansed, by pickling them in dilute sulphuric acid and scouring with sand and water or scratch brushing. Use the bath at ordinary temperatures and polish the tinned goods with whiting and the brush. 2. Can you give me any information on soluble glass? A. Consult Feuchtwanger's treatise on Water Glass and its uses.

(11) W. A. C. asks if there is a cheap process by which pine poles can be prepared for service as telegraph poles, something that would preserve them in the ground a reasonable length of time? A. Char the ends slightly and coat them thickly with wood tar.

(12) W. J. R. asks: Please answer the following in your paper. Can I build a cemented wall in water; if so, how? Machinery to pump the water out would be too costly. A. Yes, by using a diving bell.

(13) F. X. M. asks: 1. How can I preserve cider? A. See p. 81, Vol. 41, SCIENTIFIC AMERICAN, "How to Preserve Cider." 2. A stick of wood weighing 100 lb., when converted into charcoal will be very much lighter, say 60 lb. less, and yet will give a much greater amount of heat. What is the chemical process and what change has taken place? What was the 60 lb. missing from the original composed of which would seem lost? A. Your assumption that the combustion of 40 lb. charcoal develops more heat than 100 lb. dry wood is erroneous. In comparing equal weights of the combustibles, the available thermal value of charcoal is greater, as wood contains more or less water, incombustible nitrogenous compounds, and volatile combustible matters which escape complete combustion in ordinary furnaces. Consult some elementary work on chemistry and heat.

(14) F. G. asks for a receipt for making black marking ink for boxes, bales, etc. I am familiar with the japan and turpentine preparation, but desire, if possible, an ink that will flow free from the brush and not become gummy. A. Try nigrosine dissolved in boiling water.

(15) P. E. writes: I wish to protect young pear and apple trees against gnawing by rabbits, by the use of lime whitewash; but it washes off the smooth bark so rapidly by rain that it becomes impracticable. Can you tell me any addition to make to the wash that will make it adhere in wet weather? A. Try mixing a small quantity of water glass solution (10 per cent) with your lime. Wash and moisten the wood with alum water before coating.

(16) W. T. S. asks: 1. Is there as much or any more pressure at the top of a steam boiler than at the bottom? I would suppose that the most would be at the bottom on account of the weight of water and steam pressure also. Am I right? A. You are right. 2. Can you explain why an injector throws water into a boiler against the pressure? Because the momentum of the water driven by the steam at a high velocity is superior to the pressure on the valve. 3. Is an inch and one fourth steam pipe large enough to supply a seven and a half by ten engine, running from four to five hundred revolutions per minute? A. No; it should be 2 inches diameter, if the engine runs at usual speed.

(17) M. J. asks: What will remove fruit and wine stains (especially peach and claret) from table linen? A. If uncolored, moisten with dilute sulphuric acid and then rub with a strong aqueous solution of sulphite or hyposulphite of soda; or soak for a short time in a strong aqueous solution of bleaching powder (calcium hypochlorite), press out excess of the liquid, and immerse in dilute sulphuric acid (1 to 10 of water); rinse in cold water, dip in hyposulphite of soda solution, and afterwards wash out thoroughly in hot water. If colored, use plenty of soapsuds and ammonia water. See p. 2311 SCIENTIFIC AMERICAN SUPPLEMENT, No. 150.

(18) J. E. E. writes: 1. I am intending to build a steam saw mill, 45 horse power. I wish to set the engine 60 feet from the river and 10 feet above the water line. Will I be likely to have any trouble in supplying the engine with water through the pump at that distance? A. Not if your pipes are carefully laid and tight. 2. There is an idea prevalent among engineers here that an engine whose cylinder diameter is 2-3 the stroke is better for saw mills than one whose diameter is ½ the stroke, or that a 12x16 is a better proportion than 9x18. Are they correct? A. Ordinarily cylinder ½ the stroke is best. The losses from waste spaces and clearances is less.

(19) J. A. W. asks which is properly the front end of an ordinary stationary engine, the crank end or the cylinder end. A. The cylinder end is usually considered the front, whether it be a beam or horizontal engine.

(20) J. H. D. writes: I am building a light draught side wheel boat, 65 feet long, 15 feet beam, making over all 27 feet, to be propelled by 10 foot paddle wheels making 60 revolutions per minute, paddles to be 96 inches long and 10 inches dip. How many paddles would it be advisable to put on each wheel? A. Not less than 10 nor more than 12. The latter will work the smoothest.

(21) E. B. D. asks: What is the cheapest and strongest battery or electric pile you know of? A. The Grenet is cheap and strong, but not constant. You do not state how you intend to use it.

(22) C. B. C. asks whether an induction coil could be made without commutator or condenser, that would give perceptible shocks, using three or four of the large sized cells of battery described in SUPPLEMENT 149. A. A condenser is not required for a coil used for giving shocks, but some kind of an interrupter must be used in the primary circuit.

(23) S. S. D. writes: I am going to try to make an emery wheel for grinding skates, etc. What grade of emery should I get, and what should I mix with it, and how mix? A. You will hardly succeed in making a regular solid emery wheel without expensive moulds and many trials and failures. You may, however, make a serviceable emery wheel in the following way: Turn a wheel of the desired shape from a well seasoned piece of pine board. Heat some emery on an iron plate to 200° Fah., and coat your wheel with good glue of about the consistency used for wood work; roll it in the emery and allow it to dry, then give it another coating of glue and emery. When it becomes thoroughly dry it is ready for use. You should make several wheels of different grades.

(24) C. S. asks (1) how the article in No. 161 of the SCIENTIFIC AMERICAN SUPPLEMENT, about a dynamo-electric machine, is to be understood. I mean that portion describing the electro-magnet. It says there: It is not necessary to use permanent magnets. Electro-magnets may be employed, the slight residual magnetism of the soft iron cores serving to excite the armature. Now how can I make this soft iron core to be magnetic, or must the armature be a magnet? A. Temporarily connect the wires that surround it with a battery; or place it in the magnetic meridian, that is, with one pole toward the north and the other toward the south. It is hardly necessary to resort to either of these expedients, as it is almost impossible to find a piece of cast iron that is not in some degree magnetic. 2. Also please give me the title of some book on such machines; one giving experiments that may be tried with it. A. An elementary work on physics would meet your wants. Ganot's Physics is a good work for you.

(25) S. M. E. asks: 1. What effect will ozonized air have on gelatinous animal substances in course of their manufacture? Will it bleach, purify, and deodorize them? A. It would probably bleach and deodorize them to some extent. 2. Is process practicable? A. We have no record of any experiments in this line. Without a better generator of ozone (ozonizer) than any at present used, probably not. 3. Are fish scales utilized in the preparation of isinglass; if not, by what process can they be practically converted into gelatine in quantities? A. No, it remains to be devised. 4. What books give reliable information as to the various manufactures of gelatin, glue, isinglass, and preparation of hair (from cattle) for mattresses, etc.? A. Consult Dawidowsky's Leim und Gelatin Fabrikation.

(26) S. L. H. writes: I was in an assayer's office this morning and saw brought in by a miner something that he thought was very valuable, but it proved to be a mass of iron. Its greatest dimensions over all were: length 15 inches, width 10 inches, thickness 8 inches, weight 130 lb. It seems to be about the quality of best Norway iron, shows regular lamination across the mass, and has the appearance of having been thrown while at a welding heat into a bed of coarse gravel, and is not magnetic. I inclose a fragment chipped from it. It is very tough and would make good horse nails. Is this meteoric iron, or what is it, and are such things common? It was picked up about 8 miles from the Ivanpah gold and silver mines in the northern part of this county. [Judging from the small fragment sent as it is undoubtedly of meteoric

origin. Meteoric iron is perfectly malleable and may be readily worked in a forge and put to the same use as manufactured iron.]

(27) G. G. G. writes: 1. I am making an induction coil according to directions given in SUPPLEMENT No. 160, page 2548. How can I tip the screw, which presses against the vibrating spring, with platinum? A. By drilling the end of the screw and driving in a short piece of platinum wire. 2. What is vulcanite? A. Hard rubber. 3. Could not the cylinder of the commutator be made of hard wood? A. Yes. 4. How many sheets of tin foil should be used for the condenser? What size should they be? A. About 50; make them a third larger than the dimensions given. 5. Will common lead foil do, or should they be pure tin? A. Tin foil is best; ordinary tin foil will answer. It need not be made of absolutely pure tin.

(28) W. M. G. writes: 1. In your SUPPLEMENTS the figures of magneto-electric machines, induction coils, etc., are marked "half size." Do you mean exactly half size, or that the dimensions each way are one half as large as the original? A. The latter. 2. About what would be the weight of the Nos. 16 and 18 wire for the magneto-electric machine described in SUPPLEMENT, No. 161? A. About 2 lb. No. 16 and ½ lb. No. 18. 3. Should the cores for the large magnets be of wrought or cast iron? A. They would be better of wrought iron, but cast iron magnets are easier made and will answer very well.

(29) C. A. B. asks: Does the piston in a rapidly running reciprocating engine stop at the end of each stroke? A. The piston of all reciprocating engines stops at the end of each stroke, otherwise the movement could not be reversed.

(30) F. K. asks how to make a waterproof coating for cloth. A. Dissolve gum caoutchouc in excess of a bisulphide of carbon containing six per cent of absolute alcohol, concentrated by evaporation, away from the fire, as the mixture is quite inflammable.

(31) W. T. D. asks what will remove stains from kalsomined ceilings. In this country we put up a great many ceilings made out of brown muslin. The roof not being waterproof will leak on them and stain them, and rekalsomining them will not cover up the stain. A. Muslin may be bleached by soaking it in solution of bleaching powder, dipping afterward in sulphuric acid diluted with 20 parts of water, and then rinsing in plenty of cold water. 2. What will make muslin waterproof? A. See answer to F. K., above.

(32) G. P. P. asks: 1. How can carbon be soldered to brass or copper so as not to hinder the passage of electricity? A. By the process known as galvanic soldering, or you may copper your carbon by electro deposition and afterward solder the coppered surface to the brass. 2. How can a resonator be made by the use of which a Bell telephone can be heard in any part of a room 12 feet square? A. We know of nothing better than a plain funnel or trumpet similar to an ear trumpet.

(33) W. H. K. asks: Can you inform me what the preparation to polish ladies' leghorn hats consists of, as is used by straw hat manufacturers, and how to prepare and use it? A. An ammoniacal solution of bleached lac, is employed by some makers, we believe.

(34) E. H. N. writes: In a school room near by a new oak floor was laid last August. In the fall a few drops of ink were spilled on the floor, and to remove it oxalic acid in solution was applied, removing the stain where it was, but apparently leaving a kind of "halo" of darkness on the edges of the place where the acid was applied. More acid on this spread the inky matter, until, by successive applications, the color had spread all over the room. A peculiarity of the appearance is the bringing out of black color in places which seemed to have been cleared when water is spilled or sprinkled on the floor. By what means can the black be removed? A. Use a little strong hydrochloric (muriatic) acid then plenty of water; afterward dry and oil the floor.

(35) F. R. W. writes: An old photographer tells me that he at one time used bichromate of potash for a positive bath, exposing the paper through the negative for just a moment, and then using a developer which brought out the picture beautifully. He has since forgotten the name of his developer, and cannot do the same thing over. Can you tell me what would develop the picture in such a case? A. Expose the print to the vapor of aniline (oil). The bichromate should be mixed with a trace of phosphoric acid. 2. Also, if there is anything that will stick India rubber to leather, so that neither weather nor usage will separate them? A. Try a cement composed of equal parts of guttapercha and pitch.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 6, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Agricultural forks, machine for manufacturing, J. C. Richardson	223,246
Alarm bolt, S. Poole	223,394
Animal trap, W. Driscoll	223,304
Axle lubricator, P. Habel	223,295
Barrel bending press, C. Tyrrell	223,262, 223,263
Bed bottom, J. W. Price	223,396
Bed bottom, spring, C. Merrick	223,428
Bed, folding, P. Raymond	223,406
Bed lounge, F. H. Lamb	223,234
Bee bucket, G. C. & S. E. Finley	223,330
Bird cage, M. Grebner	223,340
Blow pipe, R. W. Emerton	223,326
Blower, fan, J. F. Smethells	223,300
Boiler and other furnaces, steam, O. D. Orvis	223,238
Boiler furnace, straw burning, H. K. Day	223,279
Book case, revolving, J. Danner (r)	9,033
Books with staples, machinery for stitching, J. C. Smyth	223,252
Boot and shoe, J. M. Hunter (r)	9,034, 9,035
Boot and shoe counter support, W. H. Van Wormer (r)	9,030
Bottle stopper, Dudley & Sherwood	223,325
Bottle stopper, N. Fritzner	223,266
Braid, etc., device for holding coils of, S. W. Fletcher (r)	9,028, 9,032
Bridle, J. A. Beal	223,273
Bristle bunching apparatus, J. J. C. Smith	223,399
Buckle, D. H. Palmer	223,340
Buckle, suspender, F. Kelley	223,380
Building, fireproof, K. M. Betz	223,375
Cans, apparatus for sealing fruit, E. K. & J. M. Bruce (r)	9,025
Car brake, automatic, Card & Noble	223,317
Car coupling, J. B. Purdy	223,244
Car coupling, J. N. Winn	223,426
Car lighting apparatus, railway, L. F. Randolph (r)	9,037
Car, railway, Lissberger & Samuels	223,291
Car replacer, J. P. T. Lang	223,390
Car signal, revolving, E. H. Brower	223,313
Car starter, J. Hill	223,347
Cars, ventilating, R. P. Morgan, Jr.	223,375
Carriage bow, I. N. Topliff (r)	9,030
Carriage, spring-propelled, J. A. Moore	223,378
Catapult, E. C. Bruce	223,274
Chain links, die for welding, J. H. Holm	223,345
Chair seat, G. A. Watkins (r)	9,021
Chandelier, extension, L. Brauer (r)	9,036
Chronographs minute counting attachment for, P. M. Derol	223,320
Churn, F. B. Hawley	223,296
Churn dasher, H. Tilden	223,418
Churn operating machine, L. O. Sweet	223,364
Clockwork motors, case for, S. R. Wilmot	223,423
Clutch, pneumatic safety, B. E. Henriksen	223,297
Coal and ore breaker, F. H. Sharp	223,250
Coal hod, Holzner & Vohringer	223,389
Coke ovens, gauge for building, J. W. Miner	223,372
Combs from celluloid, etc., making, W. Booth	223,311
Cooking utensil, steam, J. Ashcroft	223,267
Cornet, M. W. Heufus	223,346
Corset spring, A. Benjamin	223,211
Crockery, device for exhibiting, E. J. Ovington, Jr.	223,239
Cuff fastener, G. C. Bacon	223,304
Cut-off and valve waste pipe, Millington & Watson	223,371
Cut off for cistern leaders, automatic, H. L. Russell	223,301
Damper, J. T. Farrell	223,220
Door and shutter fastener, A. Sweetland	223,408
Drawer for safe keeping of drawings, G. B. Whiting	223,420
Dummy, R. H. Weir	223,419
Egg carrier, J. T. Fogg	223,331
Egg carrier, C. E. Losier	223,235
Electroplating with nickel, J. Wharton	223,265
Elevator, H. W. Sherrill	223,397
Engravers' tools, sharpening and preserving the bevels of, W. S. Brower	223,315
Extension table, J. D. Brassington	223,272
Eyelet, carriage curtain, C. W. Acker (r)	9,026
Faucet, A. Moore	223,374
Feather renovator, J. Shaw	223,298
Felting machine, W. Keenan	223,357, 223,358
Fence, J. F. Maris	223,368
Fence, iron, Smith & Monnadon	223,400
Fence wire, barbed, J. Haish (r)	9,026
Fence wire stretcher, G. S. Manning	223,367
Filter press, C. Furbish	223,333
Fire alarm signal box, non-interfering, Crane & Rogers	223,211
Firearm, magazine, Sweeney & Wetmore	223,410
Firearm, magazine, W. Trabue	223,414
Firearm sight, C. R. Shelton	223,251
Fire extinguisher, S. M. Lillie (r)	9,023
Fire extinguisher, J. W. Stanton	223,402
Forge fan apparatus, J. C. Duebner	223,280
Furnace, H. M. Pierce	223,393
Fuse for explosive projectiles, J. A. Brand	223,312
Galvanic battery, R. C. Anderson	223,211
Gem coating, F. E. Meyer	223,237
Glassmaker's crane, W. Hirt	223,348
Glass, ornamenting, G. W. Martin	223,369
Grain binder, D. Strunk	223,407
Grain separator, J. A. Krake	223,232
Harrow, J. P. Gage	223,334
Harrow, S. D. Gibson	223,336
Harvester, corn, W. S. Barnard	223,313
Harvesting machine, Jones & Owens	223,356
Hatchway, E. K. Furney	223,281
Hatchway doors, operating, S. N. Dickerson	223,322
Hay fork and balance, combined, G. L. Richardson	223,396
Hay rake, horse, M. Butler	223,316
Hay rake, horse, S. Ritty	223,247
Head rest, T. J. Carrick	223,276
Hoist, lumber, J. J. Hennessy	223,227
Horse detacher, J. T. Willis	223,424
Houses, apparatus for moving, J. M. Apfeld	223,306
Hydrant, P. Connolly	223,278
Hydraulic elevator, S. H. Bevins et al.	223,272
Ink, manufacture of printing, J. Kircher	223,362
Insulating steam conducting pipes, J. Brosius	223,312
Ironing table, H. L. St. Clair	223,404
Knitting machine, A. March	223,290
Knob, door, H. Tucker	223,270
Lacing tips, stock for metallic, W. E. Joslin	223,299
Lamp, S. S. Newton	223,376
Lamp, C. F. Spencer	223,254
Lamp, carriage, J. A. Roberts	223,300
Lamp, student, S. C. Catlin	223,216
Last, G. M. Wells	223,268
Lawn sprinkler, C. Chamberlin	223,277
Lemon squeezer, J. Kessler	223,360
Level, plumb, M. Harrison	223,343
Lifting jack, combined screw and lever, F. B. Stevens	223,307
Liniment, J. C. Bailey	223,306
Mop wringer, C. R. Pettengill	223,242
Music chart for key board instruments, G. S. Rice	223,243
Musical attachment for chairs and sofas, M. Schrenkeisen	223,304
Musical instruments, stringed, T. Cobb	223,319
Musical instruments, key board attachment for, C. C. Reynolds	223,307
Nail picker, E. C. Taylor	223,410
Nut lock, F. B. Davis	223,219
Oil can, S. S. Newton	223,377
Oil, transportation can and box for, Everest & Ross (r)	9,042
Ore crusher, P. C. Du Bois	223,281
Pantaloons and other garments, E. Spiess (r)	9,024
Paper box machine, F. H. Striedy	223,406
Paper machine, W. E. Phelps	223,391
Paper, manufacture of colored, R. Gmeiner	223,337
Pen, W. T. Rightmyer	223,300
Pigeon trap, W. H. Hawes	223,344
Planter and fertilizer distributer seed, M. W. Whatley	223,421
Planter, corn, J. R. & J. H. Johnson	223,353
Planter, seed, J. Custer	223,339
Planters, check row attachment for corn, W. H. Iles	223,304
Plow, M. Johnson (r)	9,031, 9,032
Plow, P. Kunder	223,361
Plow point shovel, H. C. Beebe	223,309
Pot hole lids, receptacle for, N. D. White	223,422
Potato vines, etc., machine for sprinkling, S. H. Fox	223,282
Printers, bookbinders, etc., pressing machine for, J. W. Jones	223,356
Printing machine, lithographic, H. C. Pfeil	223,243
Printing presses, die clamp for plate, L. Droka	223,223
Pulp, grinding cylinder for reducing wood to, S. M. Allen	223,306
Pump, E. S. Mack	223,236
Radiator, W. L. Phillips	223,240
Rail sanding apparatus for locomotives, A. M. Kutkner	223,231
Railway and tramway track gauge, W. F. Goodhue	223,225
Railway, elevated, C. D. Tyler	223,415
Railway joint, C. R. Schellert	223,249
Railway rail fish joint, L. B. Tyng	223,260
Railway stations, stand pipe for, Van Voest & Pratt	223,416
Reading rest, W. H. Berry	223,271
Rice hulling mill, T. M. Green	223,339
Rivet and screw blanks, machine for heading, Y. D. Upham (r)	9,027
Rotary engine, W. E. Sedlow	223,397
Sad iron, M. F. Potts (r)	9,030
Saddle loop, G. Theobald	223,411
Sash fastener, Ingram & Clark	223,351
Sash holder, N. P. Selden	223,250
Sash, window, G. Hartig	223,341
Scale beam, J. Conway	223,277
Scraper and fork, combined, G. P. Ruhle	223,399
Screw cutting machine, C. M. Spencer	223,255
Self-waiting table, W. E. Owens	223,236
Sewing machine, G. W. Hunter	223,299
Sewing machine brake, E. L. Howard	223,229
Sewing machine cording attachment, A. Lobdell	223,364
Sewing machine piping attachment, A. B. Felt	223,329
Shaft coupling, J. Geisinger	223,335
Shoe, bathing, W. J. Ryckman	223,302
Shoemaker's jack, G. M. Wells	223,364
Shutter, fireproof, W. D. Smith	223,401
Shutter worker, A. M. & W. H. Johnson	223,354
Sign hanger and support, combined, E. A. Goodes	223,224
Silk beating and washing machine, A. Urbahn	223,261
Soda water apparatus, J. Matthews (r)	9,029
Spark arrester, J. Kirkland	223,362
Spark arrester, G. Stewart	223,405
Spark arrester, M. Zeck	223,427
Stakes, apparatus for setting out slope, W. B. Soare	223,256
Stamping machine, cloth, E. G. Gibson	223,303
Steam boiler surface feeder, C. N. Peterson	223,390
Steam engine lubricator, J. W. Thompson	223,412
Steering apparatus, P. P. Secane	223,395
Stone dressing and paneling machine, S. Jenkins	223,230
Stool, camp, A. S. Drisko	223,321
Stove, cooking, G. Wellhouse	223,420
Stove fount, gasoline, G. W. Billings	223,301
Stove, oil, D. Shields	223,398
Street sweeper, E. G. Roch	223,397
Sulky, trotting, T. H. Brown	223,325
Tap or nipple for water and gas mains, T. B. Farrington	223,327
Telegraph repeater, fire alarm, Rogers & Crane	223,248
Telephone transmitter, J. H. Irwin	223,352
Tobacco drying machine, G. B. F. Cooper	223,319
Toy savings bank, R. L. Morris	223,238
Trace supporter, A. Fellows et al.	223,328
Track clearer, J. Lyker	223,365
Traction engine, J. A. Stout	223,406
Transom lifter, J. M. Axtmann	223,306
Tubing, armor for flexible, H. Wakeman	223,262
Tug, hame, G. Hazlewood et al.	223,226
Tugs, spring link for draught, J. F. Miller	223,370
Vehicle baggage attachment, E. J. Osborne	223,238
Vehicle wheel, O. J. Baldwin	223,307
Velocipede, N. S. P. Perkins	223,341
Vent valve for barrels, C. Shabley	223,396
Vermin trap or insulator, E. P. Denson	223,321
Vessels, machine for unloading, F. Imhorst	223,350
Wagon brake, W. C. Kohler	223,232
Wagon seat corner iron, R. A. Morse	223,294
Wash board, Kpemeter & Grahl (r)	9,022
Wash board, J. M. Gorham	223,388
Watch and clock movement, B. Ware	223,417
Watchmaker's tool, J. D. Allen	223,211
Watches and clocks, spring power for, B. Ware	223,419
Waterwheel, turbine, W. Mercer	223,236
Windmill, J. F. Barker	223,309
Windmill, W. H. B. Page	223,379
Windmill, B. S. Stanley	223,256
Window screen, G. Hartig	223,341
Wood bending machine, S. R. Bailey	223,320
Wool washing machine, F. G. Sargent	223,306

DESIGNS.

Card baskets or ornaments, L. D. Kosnos	11,386
Neck ruching, H. Schild	11,367

TRADE MARKS.

Beating and mixing machines, C. Lehmann	7,790
Corsets, Heilner & Strauss	7,791
Portable engines, Frick & Co.	7,780

FOR THE WEEK ENDING DECEMBER 30, 1879.

DESIGNS.

Business cards, G. H. Kendall	11,533
Chairs, E. F. Reed	11,537
Crocheted fabric, C. M. Graves	11,528
Gimp, J. Graham	11,524 to 11,526
Gimp, J. B. Thorp	11,546
Knit fabrics, C. B. Bean	11,522
Oil cloth, C. T. & V. E. Meyer	11,534 to 11,536
Woven fabric, E. Moertens	11,530 to 11,540

TRADE MARKS.

Cigars, F. Olsen	7,787
Illuminating oils, T. J. Christy	7,784
Medicine for skin diseases, G. B. Browne	7,796
Medicinal compound for the cure of fever and ague, Dr. Val. Lechner	7,786
Non-alcoholic beverage, or a compound for use in preparing it, J. L. Worden	7,790
Smoking and chewing tobacco, cigarettes, and cigars, H. Wilkins & Co.	7,785

English Patents Issued to Americans.

From December 19 to December 31, 1879, inclusive.

Alarm bells, H. Brown, Charleston, S. C.
Axles, G. W. Williams, New York city.
Belt fasteners, D. H. Jones, Hartford, Conn.
Bicycles, S. Sawyer, Gardiner, Mass.
Electric light regulators, C. F. Scribner, Chicago, Ill.
Fabric splitter, M. H. Chapin et al., New York city.
Firearms, H. A. Buck, West Stafford, Conn.
Firearms, O. Jones, Philadelphia, Pa.
Firearms, W. Trabue, Louisville, Ky.
Gas, O. Lugo et al., Flushing, N. Y.
Grain weigher, W. H. Allen, New York city.
Guns, E. G. Parkhurst, Hartford, Conn.
Harvesting machine, S. Johnston, Brockport, N. Y.
Hay press, P. K. Dederick, Albany, N. Y.
Lubricators, P. Barclay, Boston, Mass.
Neckties, P. J. Flagg, New York city.
Pencil holder, J. Reckendorfer, New York city.
Railway posts, J. S. Williams, Riverton, N. J.
Railroad rail machine, J. S. Williams, Riverton, N. J.
Railroad switch operator, J. S. Williams, Riverton, N. J.
Retorts, A. Q. Ross, Cincinnati, O.
Screw drivers, T. A. Weston, Stamford, Conn.
Ships, Z. Oram et al., Philadelphia, Pa.
Signal buoys, E. E. Mann, Lawrence, Mass.
Spring mattresses, S. H. Reeves, Brooklyn, N. Y.
Telephones, J. F. Bailey, New York city.
Telephone, A. D. Connolly et al., Philadelphia, Pa.
Thread waxing machine, S. B. Ellithorp, Rochester, N. Y.
Thread ticketing machine, W. B. Landfear et al., New York city.
Toasting iron, C. G. Stafford, Eureka, Cal.
Tramway, A. S. Hallidie, San Francisco, Cal.
Valves, F. Winters, New York city.

Scientific and Practical Books

FOR

EVERY ONE.

LIST No. 1.

Armengaud, Amoroux, and Johnson. The Practical Draughtsman's Book of Industrial Design, and Machinist's and Engineer's Drawing Companion. Illustrated by 50 folio steel plates and 50 wood-cuts. 4to, cloth. $10 00

Arlot. A Complete Practical Guide for Coach Painters. 12mo. Cloth, $1 25

Auerbach and Crookes. Anthracene: its Constitution, Properties, Manufacture and Derivatives, including Artificial Alizarin, Anthropurpurine, etc., with their Application in Dyeing, 8vo. Cloth. $5 00

Arrowsmith. Paper Hanger's Companion. 12mo. $1 25

Armstrong. Construction and Management of Steam Boilers. 12mo. Cloth. $0 75

Ashton. Theory and Practice of the Art of Designing Fancy Cotton and Woolen Cloths from Sample. 32 illustrations. Folio. Cloth. $10 00

Baker. The Mathematical Theory of the Steam Engine. 12mo, Cloth. $0 75

Baird. The American Cotton Spinner and Managers and Carders' Guide. 12mo. Cloth. $1 50

Baird. Standard Wages Computing Tables. Folio. Cloth. $5 00

Baker. Long Span Railway Bridges. 12mo. Cloth. $2 00

Bauerman. A Treatise on the Metallurgy of Iron. Illustrated. 12mo. Cloth. $2 00

Byles. Sophisms of Free Trade and Popular Political Economy Examined. 12mo. $1 50

Beans. A Treatise on Railway Curves and Location of Railways. 12mo. Tucks. $1 50

Beckett. A Rudimentary Treatise on Clocks, Watches, and Bells. 12mo. Cloth. $1 75

Burns. The American Woolen Manufacturer. Illustrated with patterns and wood-cuts. 8vo. Cloth. $2 50

Bemrose. Fret Cutting and Perforated Carving. 53 illustrations. 4to. Cloth. $3 00

Bemrose. Manual of Buhl Work and Marquetry. 90 designs. 4to. Cloth. $3 00

Bemrose. Manual of Wood Carving. 128 illustrations. 4to. Cloth. $3 00

Blenkarn. Practical Specifications of Works executed in Architecture, Civil and Mechanical Engineering, and Road Making and Sewering. 15 large plates. 8vo. $9 00

Blinn. A Practical Workshop Companion, for Tin, Sheet Iron, and Copperplate Workers. Over 100 illustrations. 12mo. Cloth. $2 50

Booth. The Marble Worker's Manual. 12mo. Cloth. $1 50

Brown. Five Hundred and Seven Mechanical Movements. 12mo. Cloth, $1 00

☞ The above or any of our books sent by mail, free of postage, at the publication prices.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo; a Catalogue of Books on DYEING, CALICO PRINTING, WEAVING, COTTON and WOOLEN MANUFACTURE, 4to; Catalogue of a choice collection of PRACTICAL, SCIENTIFIC, and ECONOMIC BOOKS, 4to; List of Books on STEAM AND THE STEAM ENGINE, MECHANICS, MACHINERY, and ENGINEERING, 4to; List of Important Books on METALLURGY, METALS, STRENGTH OF MATERIALS, CHEMICAL ANALYSIS, ASSAYING, etc., 4to; List of Books on MINING, MINING MACHINERY, COAL, etc., 4to; two Catalogues of Books and Pamphlets on SOCIAL SCIENCE, POLITICAL ECONOMY, BANKS, POPULATION, PAUPERISM, and kindred subjects; also a Catalogue of recent additions to our stock of PRACTICAL, SCIENTIFIC AND TECHNICAL BOOKS, sent free to any one who will forward his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.

ADVERTISERS

Can learn the exact cost of any proposed line of Advertising in American Papers by addressing Geo. P. Rowell & Co's Newspaper Adv'g Bureau, 10 Spruce St., N. Y.

The Field Glass.

Devoted to the Army, Navy, National Guard, Societies, and Bands. It aims to be the best periodical of the kind—one that ably

SWEEPS THE WHOLE HORIZON

of its important field. $1 a year. Sample copies free. Issued monthly by HARTLEY & GRAHAM, 17 and 19 Maiden Lane, New York, N. Y.

GROUND MICA.

The best Lubricator in the world. 50 more hot boxes. Good for Improved manufacturers of all kinds. Sample package sent to any address on receipt of $1. Address SALTIEL MICA CO., McLean's Block, St. Louis, Mo.

Baker Rotary Pressure Blower.

(FORCED BLAST.)

Warranted superior to any other.

WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA

TELEPHONE Works 1 mile. Price $4. Pat'd. Circulars free. Holcomb & Co., Mallet Creek, Ohio.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.

DAVID W. POND, Worcester, Mass.

THIS WORK IS VERY RELIABLE, AND IS STRONGLY RECOMMENDED BY THIS PAPER. It is undoubtedly the cheapest work of the kind ever published. THE WELL KNOWN REPUTATION OF THE AUTHOR IS A SUFFICIENT GUARANTEE OF ITS VALUE.

Allen's Artificers Assistant,

THE KING OF BOOKS!

SIZE, 8½ x 6 INCHES, CONTAINS MORE THAN 500 LARGE, CLOSELY PRINTED PAGES; HUNDREDS OF ILLUSTRATIONS AND DIAGRAMS, THOUSANDS OF NEW, RARE, AND VALUABLE FORMULAS, RECIPES, TRADE SECRETS, MATHEMATICAL CALCULATIONS, TABLES, BUSINESS FORMS, ETC., REPRESENTING NEARLY EVERY TRADE, PROFESSION, AND OCCUPATION IN CHRISTENDOM, and is a COMPLETE GUIDE IN ALL BRANCHES OF MECHANICAL INDUSTRY.

Fine English Cloth Binding, Handsome Gilt Back. $2.50
Fine Leather Binding, Library Edition. 3.50

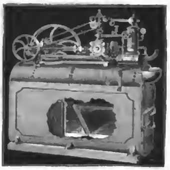
WILL BE SENT BY MAIL, POSTAGE PAID, TO ANY PART OF THE WORLD, on receipt of the price. AGENTS WANTED EVERYWHERE. LIBERAL COMMISSIONS PAID. H. B. ALLEN & CO., Publishers, 60 Murray st., New York.

62 All Chromo and Glass CARDS, 10c. 80 Agents' Samples 10c. CHROMO CARD CO., Northford, Ct.

$100 AGAINST $1.00.

We will deliver FREE FOR $1.00, with full directions, 4 lb. of our cement paint, and will guarantee to the extent of $100 to cure the most troublesome LEAKS IN ROOFS (if properly applied). This cement paint will make twice as durable, Tin & Tubs, Pails, etc., when used with it.

R. D. WASHBURN MFG. CO.,
151 & 153 Congress St., Boston, Mass.



PORTABLE AND STATIONARY ENgines and Boilers, 3 to 15 H. P. Return Flue Boiler, large fire box, no sparks. Do not fail to send for circular to SKINNER & WOOD, Erie, Pa.

FOR SALE.

Rockville Iron Works. Machine shop filled with good machinery. Price $3,500. Address ISAAC McFADDIN, Rockville, Park Co., Indiana.

PHOSPHOR-BRONZE,

ACKNOWLEDGED to be the BEST METAL for

BEARINGS, Cog Wheels, HYDRAULIC SLIDES, CYLINDERS, VALVES, Pump Rods, BOLTS, ETC.

Pamphlets and particulars on application to

The Phosphor-Bronze Smelting Co., Limited,

2038 Washington Ave., Phila., Pa.

Sole Manufacturers of Phosphor-Bronze in the U.S.

SWEEPSTAKES, WITH THE ELLIS Patent Journal Box. The best Planer and Matcher ever made. Planing 20 in. wide, 6 in. thick, weight 2,100 lbs., $350; planing 24 in. wide, 6 in. thick, weight 2,500 lbs., $400. Beading, Arbor, and Head, extra, $30. Sash, Door, and Blind Machinery a specialty. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

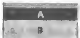
THE SUTRO TUNNEL. BY ADOLPH Sutro. An interesting address, giving the history of this celebrated mining tunnel, from its inception up to the present time, and the reasons that led to the undertaking; describing the methods that have been used in construction, the difficulties that have been encountered, and the obstacles to progress that have been met with; and prefaced by a valuable account of the discovery of the Comstock lode, and of the geological formations of the gold and silver deposits of California. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 205. Price 10 cents. To be had at this office and from all newsdealers.

Bookwalter Engine.

Compact, Substantial, Economical, and easily managed; guaranteed to work well and give full power claimed. Engine and Boiler complete, including Governor, Pump, etc., at the low price of

3 HORSE POWER $215.00
4½ " " 245.00
6½ " " 355.00

Put on cars at Springfield, O.
JAMES LEFFEL & CO.,
Springfield, Ohio,
or 110 Liberty St., New York.



RUBBER BACK SQUARE PACKING.

BEST IN THE WORLD.

For Packing the Piston Rods and Valve Stems of Steam Engines and Pumps.

B represents that part of the packing which, when in use, is in contact with the Piston Rod.
A the elastic back, which keeps the part B against the rod with sufficient pressure to be steam-tight, and yet creates but little friction.
This Packing is made in lengths of about 20 feet, and of all sizes from ¼ to 2 inches square.

JOHN H. CHEEVER, Treas. NEW YORK BELTING & PACKING CO., 37 & 38 Park Row, New York.

GREAT LABOR SAVING TOOL.

Chase's Pipe Cutting and Threading Machine, for Steam, Gas Fitters, and Machinists for cutting off and threading Pipes, Tubes, Round Iron, Bolts and Nuts, ⅛ to 1 inches. No pipe splitting. No burr inside or outside. A boy with this machine can do more work than two men with old system. No other has automatic cut-off or makes nipples.

Send for circular. Chase Mach. Co., 18 Front St., N. Y.

60 Pin-a-4, Photo, Gilt-Edge, etc., Cards, and 1 Hudson Valley Chromo, 10c. DAVIDS & Co., Northford, Ct.

IMPORTANT TO STEAM USERS.

Great Saving of Fuel.

Save repairs and prevent explosion by using the

Peerless Damper Regulator,

which regulates the draft automatically, and controls the steam pressure. In ordering mention pressure. Illustrated Catalogue sent on application.
Price, $00.00.

AMERICAN STEAM APPLIANCE CO.
SOLE MANUFACTURERS,
13 and 15 Park Row,
New York.

WATCHES From $8 up, other goods in proportion. Mammoth Illustrated Catalogue FREE
E. NASON & CO., 111 Nassau Street, New York.

The Sanitary Engineer

Of JANUARY 15 presents a summary of all facts obtained and statements printed in the past by various persons tending to show that Edison has been working in a field already cultivated, indicating that any patents he may obtain on the devices reported must be limited in scope and subject to endless litigation.

Prof. Henry Morton's article on "Water Gas" gives interesting figures of cost of manufacture and results of experiments on comparative illuminating power of water and simple coal gas.

The same issue contains a variety of other matter interesting to Sanitarians, Architects, Engineers, and intelligent readers generally.

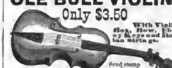
Issued on the 1st and 15th of each month. Subscription price, $2 per year; $1 for six months; single copies, 10 cents. For sale by all enterprising newsdealers. Published at 140 William Street, New York. P. O. Box 3037.

YOUR NAME and ADDRESS on 50 Gilt, Duplex, etc., Cards, in case, 13c. DAVID BROS., Northford, Ct.

AN ELEGANT IMPORTED

OLE BULL VIOLIN.

Only $3.50



With Violin Box, Bow, Ebony Keys and Italian Strings.

Send stamp for Beautiful Illustrated Catalogue of Foreign Musical Instruments. Chas. W. Story, 26 Central St. Boston, Mass.

50 Brilliant, Chromo, and Tortoise Shell Cards, in case, with name, 10c. Outfit, 10c. HALL BROS., Northford, Ct.

United States Patent for sale cheap. Well tested. Address C. H. Warrington, Box 46, West Chester, Pa.

PIANOS-ORGANS

CHEAPEST HOUSE IN AMERICA. 1st-class instruments, all new, for cash or installments; warranted 6 years. Illustrated catalogues free. Agents wanted. T. LEEDS WATERS, Agt., 28 West 14th st., New York.

Roots' Positive Blast Blower.

P. H. & F. M. ROOTS, M'f'rs, Connersville, Ind.

S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., WM. COOKE, Selling Agent, NEW YORK.

☞ SEND FOR PRICED CATALOGUE.

Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Earth Auger's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON, 26 Salisbury Street, Worcester, Mass. (Shop formerly occupied by R. BALL & CO.)

NEW BOOKS.

Pocket Book for Chemists, Chemical Manufacturers, Metallurgists, Dyers, Distillers, Sugar Refiners, etc. By Thomas Bayley. $2 00

Concrete: Natural and Artificial. Its varieties and constructive adaptations. By Henry Reid. New edition, with colored plates. $6 00

Iron Bridges and Roofs: Elementary theory and calculation of. By August Ritter. Translated from the German by H. R. Sankey. $6 00

Electric Light in its Practical Application. By Paget Higgs. 94 illustrations of Lamps, Generators, and Regulators. $3 00

Ornamental Penman's and Draughtsman's Pocket Book of Alphabets. 32 plates. $0 20

Spon's Encyclopædia of the Industrial Arts and Manufactures. Written by Practical Men and fully illustrated. Now being issued in parts at 75c. each.

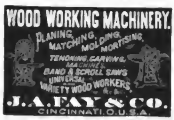
Supplement to Spon's Dictionary of Engineering. Now being issued in parts at 75c. each.

Catalogues and circulars free on application.
E. & F. N. SPON, 446 Broome St., New York.

Furnace Hoist.

ELEVATORS.

All kinds of Hoisting Machinery a specialty. Steam, Hydraulic, and Belt Power for Passengers and Freight. Iron Furnace Lifts, Portable Hoists. STOKES & PARRISH, 30th and Chestnut St., Phila., Pa.



STEAM PUMPS.

HENRY R. WORTHINGTON,

239 Broadway, N. Y. 83 Water St., Boston.

THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.

STEAM PUMPS—Duplex and Single Cylinder.

Prices below those of any other steam pump in the market.

WATER METERS. OIL METERS.

60 Queen Anne and Photo Cards, illuminated and perfumed, in case, 10c. GLOBE PRINT Co., Northford, Ct.

PATENT

Steam Hoisting Machines.

Four Sizes—4 to 10 Horse Power. The Four Horse Power will raise 1,200 lb. 150 ft. per minute. Other sizes in proportion.

NOBLE & HALL,
ERIE, PA.

LOOSE PULLEYS.

Self-lubricating, best in market. Send for circular and price list to W. OESTERLEIN, 11 Home St., Cincinnati, O.

JOHN R. WHITLEY & CO.

European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E.C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

SPARE THE CROTON AND SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N.Y., who control the patent for Green's American Driven Well.

AIR COMPRESSORS.

THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.

60 New Styles Chromo and Floral Cards, in case, 10c. 80 agts' samples, 10c. Stevens Bros., Northford, Ct.

PARTNER WANTED.—A PRACTICAL Foundryman, Machinist, or Accountant, competent to take charge. Business established in 1869. Good locality. Plenty of Work. Capital required, $3,000 to $6,000. Address SPARTA IRON WORKS, Sparta, Wis.

WANTED—DRAPER, DESIGNER, AND UPHOLsterer. Give particulars and references, and address, H. BOEH, care P. O. Box 801, Cincinnati, O.

THE BEST ARE THE CHEAPEST.

THE

FLEETWOOD and DEXTER SCROLL SAWS.

Warranted the most Accurate and Durable. The TRUMP Lathe CHUCK, for small drills—by hand or lathe. Chaps, self-centering, strong and true. Price $1.50 to $2.50. Send for circular. TRUMP BROS. MACHINE CO., Wilmington, Del.

EUROPE AND THE HOLY LAND. THIRD EDUCATIONAL EXCURSION, 1880. All Travel and Hotels first-class. COMPANY SELECT. Unsurpassed advantages. Prospectus sent free. Address E. TOURJEE, Boston, Mass.

FOR SALE.—4 Boilers, 16 feet long, 4 feet diameter, 40 horse power each—A 1 condition and make. Also 1 Berryman Feed Water Heater 42x96; 2 Rynge Power Presses, and a lot Wooden Machinery; all for sale cheap. Apply to D. L. EINSTEIN, 167 Church St., New York.

WANTED—MOULD MAKER FOR BRASS AND IRON Address, with references, J. HENDLER, care P. O. Box 801, Cincinnati, O.

HEALTH LIFT.—Mans' Practionary, also five large Electro-Magnets, weight 15 lb. each. But cores will sell cheap. L. ROMAN, 38 Fourth Street, Cincinnati, O.

1,200 per cent. profit, manufacturing our patent Anti-scalding Clothes Stick; sells at every house. License granted for 3 years, covering any county for $5.00; any township for $1.00, including sample, carriage paid. Address BAUDER & CO., Birmingham, Erie Co., Ohio.

PATENT SPARK-ARRESTER.
8—H. P. Mounted,
10 — " "
12 — " "

2-H. P. Eureka, $150.
4 " " 250.
6 " " 350.

Send for our Circulars.

B. W. Payne & Sons, Corning, N. Y.

State where you saw this.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

WOOD SOLE SHOES. The cheapest, most durable, warm good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send for circular to
CHAS. W. COPELAND, 122 Summer St., Boston, Mass.

FRIEDMANN'S PATENT
EJECTORS
Are the cheapest and most effective machines in the market for
Elevating Water and Conveying Liquids
from Mines, Quarries, Ponds, Rivers, Wells, Wheel Pits; for use in R. R. Water Stations, Factories, etc. They are splendidly adapted for conveying liquids in Breweries, Distilleries, Sugar Refineries, Paper Mills, Tanneries, Chemical Works, etc. Send for illus. catalogue to
NATHAN & DREYFUS, Sole Manufacturers, NEW YORK.

Established 1844.
JOSEPH C. TODD,
Successor to TODD & RAFFERTY,
PATERSON, N. J.,
Engineer and Machinist.
Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery, Steam Engines, Boilers, etc. Sole Agent for Mayher's New Patent Acme Steam Engine and Force Pumps combined. Also owner and exclusive manufacturer of
THE NEW
Baxter Patent Portable Steam Engine.
These engines are admirably adapted to all kinds of light power for driving printing presses, pumping water, sawing wood, grinding coffee, ginning cotton, and all kinds of agricultural and mechanical purposes, and are furnished at the following low prices:

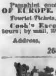
1 Horse Power, $133	1½ Horse Power, $175
2 Horse Power, 225	2½ Horse Power, 250
3 Horse Power, 275	4 Horse Power, 335

Send for descriptive circular. Address
J. C. TODD, PATERSON, N. J.
Or No. 10 Barclay St., New York.

COLUMBIA BICYCLE. A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. It augments three-fold the locomotive power of any ordinary man. Send 3c. stamp for 24 page catalogue, with price list and full information.
THE POPE M'F'G CO., 89 Summer Street, Boston, Mass.

COOK'S
GRAND EXCURSIONS to
EUROPE!
1880 For the Summer of 1880
ANNUAL MAY PARTY.
GRAND ANNUAL EDUCATIONAL VACATION PARTY.
ANNUAL MIDSUMMER PARTY.

Pamphlet containing full particulars, with MAP OF EUROPE, sent free on application.
Tourist Tickets, for Independent Travelers by all routes.
Cook's Excursionist contains fares for over 1,000 tours; by mail, 10 cents.
Address, THOMAS COOK & SON, 261 Broadway, New York. P. O. Box 4197.



SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO., 331, 333, 335, & 337 West Front Street, Cincinnati, Ohio.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

HARDWARE, WOODENWARE,
and NOVELTIES suitable for European markets. Price lists and lowest cash discounts wanted by an Exporting House having branch in Europe. Would be glad to correspond with manufacturers of staple goods or patent articles with a view of taking sole agency. Have facilities for reaching the best houses in Europe. Address MANUFACTURER, P. O. Box 2866, New York City.

80 Samples Photo, Duplex, etc. Cards 10c., Autograph Album, 13c. Conn. Card Co., Northford, Ct.

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

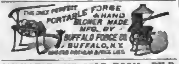
The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought
STRUCTURAL IRON.
It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished on application.

BOILER COVERINGS.
WITH THE "AIR SPACE" IMPROVEMENTS.
THE CHALMERS-SPENCE CO., Foot E. 9th St., New York. Sole owners of the Air Space Patents.

WIRE ROPE
Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.
Wheels and Rope for conveying power long distances. Send for circular.

Gear Molding without Patterns
Scott's Gear Moulding Machines,
AIR COMPRESSORS & ROCK DRILLS.
DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
FOOT OF W. 13th ST., North River, NEW YORK.
ESTABLISHED 1841.

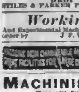
$777 A YEAR and expenses to agents. Outfit Free. Address P. O. VICKERY, Augusta, Maine.



ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.

Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

FLIGHT AND ITS IMITATION.—BY Fred. W. Brearey, Hon. Sec. of the Aeronautical Society of Great Britain. An interesting essay, discussing the present status of the question as to the possibility of aerial locomotion being accomplished by man; pointing out the mechanical conditions of flight which must be thoroughly understood before they are attainable, and explaining the various reasons on which those who are working at the problem found their hopes of ultimate success. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 207. Price 10 cents. To be had at this office and from all newsdealers.



THE
Eclipse Engine
Furnishes steam power for all Agricultural purposes, Driving Saw Mills, and for every use where a first-class and economical Engine is required. Eleven first-class premiums awarded, including Centennial, '76. Refer to No. 7, issue of '77, No. 14, issue of '78, of SCIENTIFIC AMERICAN, for Editorial Illustrations.
FRICK & CO., Waynesboro, Franklin Co., Pa.
When you write please name this paper.

PHOTOGRAPH VISITING CARDS. Send 10c. for circular and 25 samples. SEAVY BROS., Northford, Ct.

BOYLE ICE MACHINE CO.,
10 N. Jefferson St., Chicago, Ill.
The best Ice and Refrigerating Machines of all sizes and for all purposes guaranteed. Send for circular.

DROP HAMMERS.
STILES & PARKER PRESS CO., Middletown, Conn.

Working Models
And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.

PARSONS NON CHANGEABLE [illegible] LATHE [illegible] WORKS [illegible]
GREAT FACILITIES FOR LARGE OR MEDIUM [illegible] FRONT ST. [illegible]

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

PRINCIPLES OF HORSE SHOEING.—By Geo. Fleming, V.S. A paper describing the proper method of shoeing horses so that the animal's feet may be kept always healthy and sound. How much the walls of the hoof should be reduced, and how the operation should be performed; the kind of shoes that should be selected; how they should be fitted, the number and size of nails that should be used, and how the face of the hoof should be treated. Followed by a description of a modified form of the "Charlier" method so successfully followed by the author for many years. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 205. Price 10 cents. To be had at this office and from all newsdealers.

H.W.JOHNS' ASBESTOS
Liquid Paints, Roofing, Boiler Coverings, Steam Packing, Sheathings, Fire Proof Coatings, Cements, &c. Send for Descriptive Price List.
H. W. JOHNS M'F'G CO. 87 MAIDEN LANE, N.Y.

$2 WATCHES. Cheapest in the known world. Agents wanted. Address COULTER & CO., Chicago.

62 Gold Crystal Lace, Perfumed, and Chromo Cards, name in Gold & Jet 10c. Clinton Bros. Clintonville, Ct.

PERFECT
NEWSPAPER FILE
The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address MUNN & CO., Publishers SCIENTIFIC AMERICAN.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

ORGAN BEATTY PIANO
New Organs 13 Stops, 3 set Golden Tongue Reeds, 5 Oct's, 2 Knee Swells, Walnut Case, warn't'd 6 years, Stool & Book $98. New Pianos, $143 to $255. Newspaper sent Free. Address Daniel F. Beatty, Washington, New Jersey.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

SALESMEN WANTED $125 A Month and Expenses, [illegible] SAMPLES FREE. Send 3c. STAMP to [illegible] CIGARS. S. FOSTER & CO., Cincinnati, O.

TRY IT
HOE'S LITTLE GIANT INJECTOR
IMPROVED
THE GREAT BOILER FEEDER
IT IS RELIABLE

THE PICTET
ARTIFICIAL ICE COMPANY, Limited.
Ice Machines to make from 20 pounds per hour to 50 tons per day, at 26 Cortlandt St., New York. P. O. Box 3083.

NEW AND 2D-HAND ENGINES AND BOILERS CHEAP for cash. O. B. GOODWIN, Oil City, Pa.

ROOFING.
For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free.
T. NEW, 32 John Street, New York.

20 H. P., $275. "RELIABLE"

Vertical and Horizontal Engines, with Waters' Governor, equal to any in simplicity, durability, and efficiency. Other sizes from 10 to 20 H. P. at prices equally low. For illustrated circular, address
HEALD, SISCO & CO., Baldwinsville, N. Y.

DELAWARE RIVER GUNNING SKIFF.—Detailed description, accompanied by figures drawn to a scale showing the mode of construction of a "duck boat" or "gunning skiff" which cannot fail to recommend itself to sportsmen. These boats are 12 to 15 feet long, the smaller being best for two persons, while the larger makes an excellent rowboat for hunting, fishing, and pleasure. Owing to their light weight and flat bottom they may be pushed over the mud where there is not enough water to float them, or may be easily dragged over grasses or sedges at portages without injury. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 207. Price 10 cents. To be had at this office and from all newsdealers.

VALUABLE PATENT CHEAP FOR CASH. Revolving Sulkey Harrow. Patented 1878. All territory with exception of Kansas and Missouri. Single States or all. Fortune for right parties. Send for circulars.
G. H. GABLE, Corpus Christi, Texas.

50,000 Agents wanted by 1,000 advertisers in the Agents' Herald, Box 5, Philadelphia, Pa.

An engine that works without Boiler. Always ready to be started and to give at once full power.
SAFETY. ECONOMY. CONVENIENCE.
Burns common Gas and Air. No steam, no coal, no ashes, no fires, no danger, no extra insurance. Almost no attendance.
THE NEW OTTO SILENT GAS ENGINE.
Useful for all work of small stationary steam engine. Built in sizes of 2, 4, and 7 H. P. by SCHLEICHER, SCHUMM & CO., 3045 Chestnut Street, Phila., Pa. H. S. Manning & Co., 111 Liberty St., N. Y., Agents.

Cigar Box Lumber,
MANUFACTURED by our NEW PATENT PROCESS.
The Best in the World.
SPANISH CEDAR,
MAHOGANY,
POPLAR.
Also thin lumber of all other kinds, ⅛ to ½ in., at corresponding prices. All qualities. Equal in all respects to any made, and at prices much under any to be obtained outside of our establishment. Send for price list.
GEO. W. READ & CO., 186 to 200 Lewis Street, N. Y.

TIGHT & SLACK BARREL MACHINERY
A SPECIALTY
JOHN GREENWOOD & CO.
ROCHESTER N.Y.

A New Spinning Band.
ROWBOTTOM'S PATENT DOUBLE LOOPED SPINNING BAND. Suitable for all kinds of Spinning and Doubling Frames for Woolen, Worsted, Cotton, Flax, or other fibrous substances. Is FREE FROM KNOTS, neat, speedily adjusted, runs steadily, and avoids the annoyance of lint. Price, fifty cents per pound, delivered at the mill. Sample orders solicited. State kind of machinery, diameter of Driving Cylinder, and actual length required when in operation.
STODDARD, LOVERING & CO., Sole Agents, No. 10 Milk Street, Boston, Mass.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES
AND
AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG MASS.

THE DRIVEN WELL.
Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by
WM. D. ANDREWS & BRO., 235 BROADWAY, NEW YORK.

RELIABLE. DYKES' BEARD ELIXIR [illegible]

Grain Speculation!
Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., Chicago, Ill., for Circulars.

$3 Printing Press Prints cards labels &c. (Self-inker $4) 18 larger sizes. For business or pleasure, young or old. Do your own advertising and printing. Catalogue of presses, type, cards, &c., for 2 stamps. Kelsey & Co. Meriden, Conn.

Lathes, Planers, Shapers
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.

BROWN'S PAT. SPLIT PULLEYS
Shafts, Hangers.
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

1880. 1880. 1880.
The Scientific American
FOR 1880.
THIRTY-FIFTH YEAR.
VOLUME XLII. NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Third day of January, 1880, a new volume was commenced. It will continue to be the aim of the publishers to render the contents of the new volume as attractive and useful as any of its predecessors.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

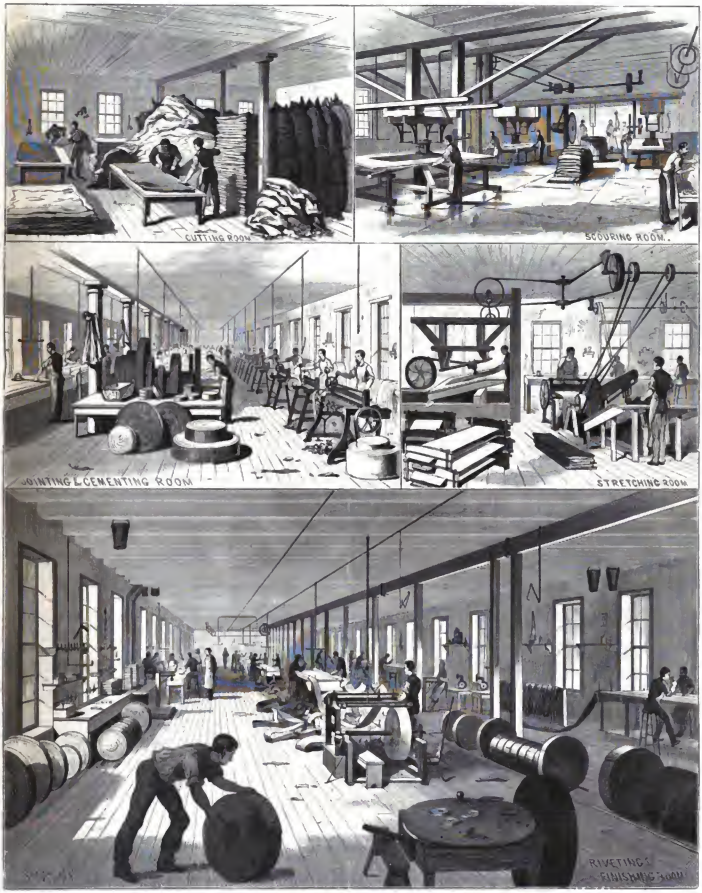
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 7. [NEW SERIES.] NEW YORK, FEBRUARY 14, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]



P. JEWELL & SONS' LEATHER BELTING FACTORY, HARTFORD, CONN.—[See page 101.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, FEBRUARY 14, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 215,

For the Week ending February 14, 1880.

Price 10 cents. For sale by all newsdealers.

HOW GREAT INVENTIONS ARE MADE.

There is a very prevalent notion that an inventor is a tinkering fellow, an uneasy sort of mechanic who is always experimenting, cutting, and trying, with a vague expectation of some day hitting upon something novel and possibly useful. Doubtless there are in almost every community men who waste their time and means in brainless labor of that character, would-be inventors, who, having no clean cut or well considered purpose in view, are ever busy at nothing, making a show of invention without ever inventing anything. But such men are no more worthy of the name of inventor than the corner loafer who wrangles over the affairs of local politics is worthy of the name of statesman.

The real inventor is a man of an entirely different type. He knows precisely what he is driving at, and very frequently his invention is entirely thought out before the first stroke is made to put it upon paper or to shape it in a more material form. "When you strike a difficulty, what do you do?" was asked of an inventor whose fame is world wide for his many achievements in overcoming alleged impossibilities. "I sit down and think," was the sufficient reply.

The capacity to think is the inventor's first and most essential endowment, and no amount of tinkering, however patient and mechanically skillful, can ever take its place. A striking example of the true inventor's ability to think creatively is furnished in the inventions of the late Erastus B. Bigelow. He was not a mechanic, he had no practice in the use of tools, he could not even handle a pencil with skill and facility. His inventions were made in the recesses of his brain, where the complicated machinery of each was created, thought out in detail, before any attempt was made to give it material embodiment. To a writer in the last issue of the *Bulletin* of the National Association of Wool Manufacturers, Mr. Bigelow said that his most recent carpet loom—one upon which seventy-two yards of Brussels carpet have been woven by one girl in ten hours—was completely worked out in his mind and mapped upon his brain, not in his study or factory, but in the railroad cars while making his last visit in Europe. After sating his mind and eyes with foreign sights and scenery, an irresistible fit of invention came over him. Re tiring within himself, the machine soon assumed in his mind complete form in every part and detail. Showing a rough sketch of the invention, the only drawing of it that had been made, Mr. Bigelow said: "All I have now to do is to direct a draughtsman to work in the details." Subsequently the narrator saw the draughtsman in the inventor's study, under his direction, at work upon the drawings from which the machine was to be constructed. The inventor, copying from the plans imprinted on his brain, dictated to the draughtsman (who acted as a mere pantograph) every line, circle, and curve which was to be transferred to the paper, giving its exact place, length, and dimensions. The result was a working drawing, from which alone the machinists were able to construct a perfect machine, working without experiment or adjustment exactly as it was contrived by the inventor.

The difference between the working of a mind like Mr. Bigelow's and that of an inferior inventor is one of degree, not of kind. The same kind of thinking is done with more or less thoroughness by every true inventor. And those who stop short in their creative thinking and begin to materialize their invention too soon only multiply their chances for going wrong, increase their labor needlessly, and demonstrate their incapacity to reach the higher levels of the art of invention. To begin to build when the object is but vaguely apprehended is to invite confusion and failure by turning the mind off from the highway of invention to the bewildering by-paths of unintelligent experimentation.

In that wide field of invention in which the self-imposed task of the worker is to accomplish a new result by a wise choice and combination of known means, the rules to be followed are admirably set forth in Mr. Bigelow's description of the working of his own mind in developing the inventions for which he is so honorably known. Speaking upon this point he said:

"My first step toward an invention has always been to get a clear idea of the object aimed at. I learn its requirements as a whole, and also as composed of separate parts. If, for example, that object be the weaving of coach lace, I ascertain the character of the several motions required, and the relations these must sustain to each other in order to effect the combined result; secondly, I devise means to produce those motions; and thirdly, I combine those means and reduce them to a state of harmonious co-operation. To carry an invention through the first and second stages is comparatively easy: the first is simply an investigation of facts; the second, so far as I can trace the operations of my own mind, comes through the exercise of the imagination. I am never at a loss for means in the sense above explained. On the contrary, my chief difficulty is to select from the variety always at command those which are most appropriate. To make this choice of elementary means and to combine them in unity and harmony—to conduct, that is, an invention through its last practical stages—constitutes the chief labor.

"In making this choice of elementary parts one must reason from what is known to what is not so—keeping in mind, at the same time, the necessary combinations, examining each element, not only in reference to its peculiar function, but to its fitness also for becoming a part of the whole. Each device must be thus examined and re-examined until harmony and unity are fully established. I find no difficulty in effecting that concentration of thought which is so necessary in pursuits like mine. Indeed it is not easy for me to withdraw my mind from any subject in which it has once become interested until its general bearings, at least, are fully ascertained. I always mature in my mind the general plan of an invention before attempting to execute it, resorting occasionally to sketches on paper for the more intricate parts. In building a machine a draughtsman prepares the working drawing from sketches furnished by me, which indicate in figures the proportion of the parts, I never making anything with my own hands. I do not like even drawing to a scale."

Inventors less favored by nature with the power of close and long continued mental concentration which Mr. Bigelow was blessed with, or lacking the vividness and accuracy of his conceptions and the strength of memory which enabled him to hold fast the mental image of a complicated machine which his imagination had put together, may have to resort sooner to the pencil sketch or the material model. But these are apt to become distractions rather than aids, and the young inventor should study to do without them as long as possible. The moment the inventor materializes an idea his power over it is so far lessened. If the material form is not just what it should be to suit the ultimate combination it is far harder to recast it, in the third stage of invention as described by Mr. Bigelow, than it would be if preserved as a purely mental conception.

Of course to the man who has creative mental power, a hand skilled in the arts of drawing and mechanical construction may be, and if properly exercised will be, a desirable adjunct in the art of invention; but it is not an essential factor, for many successful inventors have been, like Mr. Bigelow, unable to give their new conceptions material embodiment; and where manual skill furnishes a too ready incentive to the overhasty materialization of crude ideas, it is an accomplishment which the genuine inventor can well afford to dispense with.

THE IMPOLICY OF ANTI-PATENT COMBINATIONS.

The report of the Executive Committee of the Western Railroad Association for 1879 sets off with the following:

"*Duties of Members.*—The members of the association can not be too frequently or too forcibly reminded of their duties in the association, which consist, chiefly:

"I. In introducing no new device, process, or appliance, and to make no change in those now in use, without submitting the same for an opinion as to what and how many patent or patents the same is subject to; and

"II. The entertaining, much less the settling, of no patent claim without an investigation thereof by the association; and never, except in extraordinary cases, settling any such claim contrary to the advice received."

When the National Association of Wool Manufacturers was founded, an especial object of many of its prominent promoters was a combination to resist certain patents which were supposed to bear heavily upon wool manufacturers. Against this course the first president, Erastus B. Bigelow, took the high ground that the association had better work to do. He said that if the association should attempt to inquire into the validity of patents they would be liable to the imputation of combining to defeat inventors. They had no power to decide questions of patent rights; and if they were to go into any court as a body in opposition to any patent, they would only invite defeat through the prejudice which such a combination would excite. He begged the association not to weaken its influence by going before the public with any object which public opinion would not regard as perfectly legitimate; and his wisdom carried the associated wool manufacturers with him, and decided their future policy.

We are confident that the association has not regretted its diversion from what at first seemed to many its primary purpose, and we have never heard that the wool manufacturing interest has grievously suffered at the hands of the numerous inventors who have so largely revolutionized the work of the woolen trade.

The Western Railway Association have undertaken to do what the wool manufacturers wisely saw to be impolitic, and the peculiar relations subsisting between railway corporations and the public are such as to make it vastly more impolitic on their part to combine for anti patent purposes. The manufacturers of wool had received no favors at the hands of the general public, and their work was strictly private in character. Not so the work of the railway companies. They have received large grants of land and other valuable franchises from the public, not for the enrichment of their stockholders, but for the public good. They are common carriers, and in view of the conditions under which they come into existence, the community has a right to insist that the carriage of persons, property, and mails by them shall not be needlessly delayed or rendered needlessly hazardous.

Should an association of wool manufacturers decline to give place in their factories to an improved loom, they would be foolish, but, being under no obligation to the public, they would not be amenable to that public for their folly. For railway companies to combine to prevent the adoption, say, of an improved brake, is a very different matter; and the associated railway companies cannot afford even to be suspected of such action. As a natural effect of their unwisdom in this respect, we see before Congress a bill to compel railways to adopt and use improvements calculated to increase the safety of passengers and mails. The railway managers say that this is an unwarrantable and an unjust invasion of their rights; but that is a question for

the courts to decide, should the proposed bill be passed by Congress.

Right or wrong the attempt by Congress to compel railways, as General Banks' bill reads, to "put into actual and continual use such inventions and improvements as shall, upon thorough trial tests, actually contribute to the comfort, security, and safety of persons being transported as passengers," and tend to prevent delays in the transmission of mails, etc., may be taken as a natural and inevitable result of the attempt on the part of the associated railways to refer all action with reference to improvements to an outside and irresponsible organization. And as the people of the United States are more numerous and more powerful than any possible association of railway officials, it is the reverse of politic on the part of the latter to provoke a conflict which can only result in their overwhelming defeat.

THE WESTERN RAILWAY ASSOCIATION AND THE PATENT LAWS.

Speaking of the failure of their efforts to secure the passage of the bill to effect a general amendment of the patent laws last winter, the executive committee of the Western Railroad Association say, in their report for the year just closed:

"For many reasons, but principally on account of the success which has of late attended the work of the association in contesting unjust claims, and in settling just ones equitably, your committee has made no special efforts in this direction during the present Congress."

American inventors will be pleased to see this frank admission by the association that for all legitimate purposes the patent laws are adequate as they stand. No fuller justification could be asked for the position taken by the friends of inventors during the contest in the last Congress, namely, that the general invasion of the constitutional rights of inventors proposed in the Association's bill (S. 300), was as unnecessary as its object was unjust. Now, having admitted that the present laws are sufficient to enable them to contest successfully unjust claims, and to settle just ones equitably—certainly all that any association can reasonably ask—it is to be hoped that the Western Railway Association will have the grace to cease to whine about the alleged oppressions of patentees, and refrain from further attempts to have the patent system recast so as to place inventors at the mercy of any who might choose to infringe their rights.

THE PROPOSED WORLD'S FAIR IN 1883.

One decided advance has been made toward securing a World's Fair in this city three years hence. The two rival organizations which had the project in hand have given place to a single committee made up of citizens of accredited social and financial standing. There has also been introduced in Congress a bill creating for the management of the proposed Fair a United States International Commission, composed of sixty honorably known citizens of New York, two commissioners from each State, one from each Territory, and one from the District of Columbia. It is further provided in the bill that the Exhibition be held under the direction of the Commission as one body; that the Board of Finance be elected by the subscribers to the stock, and that those elected thereby become, if not already so, a part of the Commission—thus avoiding any troubles that might arise from a dual organization; that the capital stock be placed at twelve millions of dollars, in shares of ten dollars each; and that foreign nations be invited by the general government to participate in its exhibition.

No appropriation is asked for, but there is no provision against such an application in the future. The list of incorporators is made up of names that ought to inspire confidence. Each of the gentlemen named has agreed to serve on the commission, and all together they furnish a reasonable guarantee that the undertaking will be wisely managed.

THE LOGIC OF GOVERNMENT CONTROL.

For a number of years the propriety of transferring to the National Government the control of railways and telegraphs, as in some European States, has been strongly urged in this country. This, on the plea of cheapness and good management, notwithstanding the too frequent experience that the business affairs of the government are apt to be badly conducted, and their results obtained at a far greater cost than for similar work in private hands.

The action of the British Postmaster General in relation to the telephone companies furnishes a pretty illustration of the logical result of such government monopolies. Every one knows that a few years ago the British Government acquired possession of all the telegraph lines of the United Kingdom, and made them a part of the postal service. By the same act, as English electricians aver, the government put a practical extinguisher upon telegraphic improvements in Great Britain—a natural result of bureau management. But this is not the worst of it. Government monopolies are not only fatal to progress in their tendency to discourage invention, but they are very apt to become aggressive, and try to suppress outside rivalry. Hence the natural but none the less amazing attack upon the English telephone companies by the Right Honorable Lord John Manners, who filed an information in the Court of Queens Bench, Jan. 20, asking an injunction to restrain the English Telephone Company and Edison's Telephone Company from using wires for the transmission of messages.

The next day in the Exchequer division of the High Court of Justice, application was made by the Attorney General on the part of the Post Office for an *ad interim* injunction to restrain the English Telephone Company and the Edison Telephone Company from discharging the functions for which they were called into existence. After some discussion it was arranged that an injunction should not be taken, but that the defendant companies were to keep certain accounts until the hearing and final decision of the case. The argument on behalf of the Post Office is that telephones are telegraphs within the meaning of the act by which the latter inventions were committed to the charge of the Post Office Department, and the Attorney General represented it to be a serious grievance that the government, after spending millions on telegraphs, now found their monopoly interfered with by telephones, which he submitted were practically the same invention. It is reported, although this part of the question was not mentioned during the hearing, the Post Office officials hope to be able to compel the telephone companies to take out licenses from the Postmaster General and pay royalties for carrying on their business. The trial of the case is set down for an early day in February.

THE OWNER OF THE CAPE OF GOOD HOPE AND HIS OSTRICH FARM.

Mr. McKellar, who was most kindly hospitable, has an ostrich farm, but his flock of birds was not very large at the time of our visit, he having had bad luck at first in breeding.

He owns the actual Cape of Good Hope and a long stretch of the moorland adjoining, and has thrown a wire fence right across the peninsula, so as to give his ostriches the run of a large tract, stretching right down to the cape itself. One old hen ostrich was a pet about the house, but used to do sad damage in the farm yard eating the young goslings, swallowing them like oysters.

It was amusing to go with Mr. McKellar into one of his breeding paddocks; here a pair of ostriches were brooding on a nest of eggs, dividing, as usual, the labor between them. The cock was very savage and attacked all intruders, so his master had a long pole with a fork at the end of it, and when the ostrich ran at the party he caught its neck in the fork. The ostrich was excessively enraged, but soon had to give in.

A kick from an ostrich is well known as very dangerous. The only thing to do when attacked without means of defense, Mr. McKellar said, is to lie flat down and let the bird walk on you till he is tired. I was astonished at the brightness of the red coloring developed on the front of the legs of the cock bird during the breeding season. The ornamental appearance of the bird is greatly enhanced by it.

A narrow but strong and high pen is provided for plucking the birds in. They are driven into it and held fast. It is found better to pluck the feathers out than to cut them off. The stumps, if left in, are apt to cause trouble.

Young ostriches, when first from the egg, have curious horny plates at the tips of their feathers, like those in the feathers of one of the Indian jungle fowls, and some other birds not in the least related to one another.

The cape peninsula becomes very narrow towards its termination, and ends in two capes, Cape Point, on which is the lighthouse, and the Cape of Good Hope. The Cape of Good Hope itself is a mass of rock, terminating in perpendicular cliffs toward the sea, but with ledges here and there, on which numbers of cormorants (*Phalacocorax capensis*) nest.—*H. N. Moseley, Challenger Notes.*

Sewer Gas and Disease.

The authorities of one of the largest hospitals in London lately took measures to ventilate all the drains and sewers in connection with their institution. Up to the time these alterations were made, pyæmia and erysipelas had almost driven the medical staff to despair. When the whole of the ventilation was completed, and as soon as the pressure was removed from the traps of the closets and lavatories, no fresh cases were found to occur. For months the hospital wards were free from both erysipelas and pyæmia. Suddenly, however, there was a fresh outbreak of these diseases, but it was noticed that the epidemic was confined to one of the surgical wards, built apart from the main building, on the pavilion plan, and having only one story. Close investigation proved that the ventilation pipe in this wing had been stopped up by a careless workman. When this was remedied, all traces of the epidemic disappeared.

The Millers' International Exhibition.

A bill was passed in the House of Representatives, January 15, providing for the importation, free of duty, of all articles for exhibition at the Millers' International Fair, to be held in Cincinnati, Ohio, during the coming summer. The Exhibition will be opened June 1. The machinery will be shown in motion.

In view of the enormous interests involved in milling, the variety of grains made use of, the numerous rival systems and processes employed, and the wide range of invention covered by milling apparatus, it is safe to predict a notable Exhibition. American millers and mill furnishers are taking a lively interest in the Fair, and the president of the National Millers' Association reports a fine prospect for a full and instructive display.

MACASSAR OIL.—Sunflower oil, 100 grammes; goose grease and "kamfett," of each 15 grammes; liquid storax, oil of eggs, oil of thyme, cacao butter, of each 8 grammes; neroli, 4 grammes; Peruvian balsam, 0·6 gramme; otto of roses, 0·05 gram.—*Henkenius.*

Kind Words from Chicago.

Our newspaper contemporaries are constantly saying good words for the SCIENTIFIC AMERICAN and our other publications. We are not unmindful of such courtesies, although we seldom occupy space in these columns for giving them expression; but the following from the Chicago *Journal of Commerce* is so well put, we beg the indulgence of our readers for giving it place:

"The SCIENTIFIC AMERICAN is one of the really standard publications of the day. Established in 1845, it has now reached the thirty-fifth year of its publication. The success of this publication has been something remarkable, and its circulation is now *fifty thousand copies* weekly. It is a paper that ought to find its way into every workshop in the land, without a single exception. It is invaluable to the mechanic, artisan, and inventor, and the wide field it covers makes it alike invaluable to those interested in purely scientific and chemical pursuits. Its handsome pages and accurate illustrations of new inventions, machinery, workshops, and sketches in natural history are all in entire keeping with the active spirit of this progressive age, and there are, indeed, few publications more deserving of a place in the homes of our land. The SUPPLEMENT—which is a distinct paper from the SCIENTIFIC AMERICAN—contains sixteen octavo pages, with handsome cover, uniform in size with the SCIENTIFIC AMERICAN. This is really a royal issue, and while the price of the SCIENTIFIC AMERICAN is placed at $3.20 per year, or $1.60 for six months, the SUPPLEMENT is placed at $5.00 per year, postage paid, to subscribers. Money could not be more judiciously expended than by subscribing for these publications."

The Indian and the Telephone.

An amusing application of the wonders of the telephone as an assistant detective of crime comes to us from Julian. Several horses were recently stolen in that neighborhood, and suspicion fell upon a certain Indian as the thief. Some one having introduced a telephone up there, the same was being exhibited, when it occurred to the owner of the stolen horses to get the Indian to come in and hear the "Great Spirit" talk. The Indian took one of the cups and was thrilled with astonishment at being apparently so near the Great Keeper of the happy hunting grounds. After some little time spent in wonderment, the Indian was solemnly commanded by the Great Spirit to "give up those stolen horses!" Dropping the cup as if he had been shot, the Indian immediately confessed to having stolen the horses, and tremblingly promised if his life was spared he would restore the "caballos" at once, and he did so.—*San Diego (Cal.) Union.*

Curiosities of the Telephone.

With a single telephone held, say, to the right ear, the transmitted voice appears to come from a distance to the right; while with a telephone held to the left ear, it seems to arrive from the left of the listener.

With a telephone to each ear, if one ear be less sensitive than the other, or if the telephone be held further from that ear, the voice apparently shifts to the side of the other ear; and if both ears hear alike and both instruments are equally near their respective ears, the voice apparently proceeds from in front of the observer.

Petroleum in Hanover.

Borings are being made in the Hanover petroleum district with such promising results as to make the prospectors extremely hopeful. A dispatch from Berlin says that the borings are now 60 feet deep, and the existence of a petroleum basin as large and rich as the one in Pennsylvania is regarded as beyond doubt by mining experts. The deepest borings already yield four hundredweights of oil per well daily, and the quality of the oil is improving. The work is being prosecuted by Hamburg and Bremen firms engaged in the American trade.

Cheap Indelible Ink.

Braconnot recommends the following: 20 parts of potassa are dissolved in boiling water, 10 parts of fine cut leather chips and 5 parts of flowers of sulphur are added, and the whole heated in an iron kettle until it is evaporated to dryness. Then the heat is continued until the mass becomes soft, care being taken that it does not ignite. The pot is now removed from the fire (allowed to cool), water is added, the solution strained, and preserved in bottles. This ink flows easily from the pen.—*Pol. Notizbl.*

Large Farming.

It is reported that Mr. Oliver Dalrymple, the great Minnesota farmer, intends to cultivate 30,000 acres of wheat this year. He will have 30 steam thrashers in operation with 135 reaping machines. Last year he employed 600 laborers, and this year will increase the number to 700.

THE woolen trade in France has been making rapid progress. In 1851 there were only 850,000 woolen spindles in that country, but now they number 2,270,000, thus distributed among the departments: Nord has 1,350,000; Marne, 160,000; Somme, 125,000; Ardennes, 120,000; Aisne, 140,000; others, 375,000. The value of the woolen yarns exported amounted to 32,200,000 francs; of manufactured goods, to 464,200,000 francs; of combed wool, to 30,900,000 francs; of woolen waste, to 36,700,000 francs; making a grand total of 564,000,000 francs. About 147,632,000 francs were paid for wages annually.

HINTS TO THE YOUNG STEAM FITTER.

BY WM. J. BALDWIN.

RADIATION.

Heating surfaces are divided into three classes: 1st, direct radiation; 2d, indirect radiation; and 3d, direct-indirect radiation.

Direct radiating surfaces embrace all heaters placed within a room or building to warm the air, *and are not directly connected with a system of ventilation.*

The best place in a room to put a radiator is where the moist air is cooled—namely, before or under the windows, or on the outside walls. When the heater is a vertical tube radiator, or a short coil, which can occupy only the space of one window, and, as often happens in corner rooms, there are three windows, the riser should be so placed as to bring the line of radiators in front of and under the windows where they will do the most good—say the middle window; or, better still, when a small extra cost is not considered, use two heaters, and place one in front of each extreme window.

When the room is large and has many windows, the heating surface should be divided into as many parts as there are windows; or, if the occupants object to so many windows being partly obstructed, divide into half as many parts and distribute accordingly.

In schools or buildings with many windows, where children or persons cannot change their positions, but have to remain seated for several hours at a time, care must be taken that the heating surface is very evenly distributed. A miter coil run the whole length of the outside wall is best, but if any kind of short heaters are used, every window should have its quota. Should a single window be left unprovided for, it will be found by experiment that a cold current of air will fall down in front of said window and flow along the floor in the direction of the nearest heaters, and cause cold feet to any who are in its passage.

The natural currents in a room, with the outside atmosphere the coldest, are down the windows and outside walls, and up at the center or rear walls. This downward and cold current should be met by the heated and upward current from the radiator, and reversed and broken up as much as possible.

Indirect radiation embraces all heating surfaces placed outside the rooms to be heated, *and can only be used in connection with some system of ventilation.*

There are two distinct modifications of indirect radiation. One where all the heating surface is placed in a chamber, and the warmed air distributed through air ducts and impelled by a fan in the inlet or cold air duct. The other where the heating surface is divided into many parts, and placed near the lower ends of vertical flues leading to the rooms to be heated.

The first of this class—namely, *chamber-heat*—has not proved a great success, and architects and steam heating engineers are likely to have very little more to do with it, as it has been found that in windy weather it is almost impossible to force air to the side of a house or building against which the wind blows. The second of this class has done better, as it admits of taking advantage of the force of the wind to aid in bringing the warmed air into the rooms.

In estimating the heating surface for low pressure indirect radiation it is well to nearly double what would be used for direct radiation; but when the steam pressure is high, and the supply ample to maintain the pressure in the heater, the surface may be reduced directly as to the increase in temperature of steam to be carried.

The indirect heater is usually boxed, either in wood lined with tin or in sheet metal. The former is best when the cellar is to be kept cool, as there is a greater loss by radiation and conduction through metal cases; otherwise metal is best, as it will not crack, and when put together with small bolts, can be removed to make repairs without damage.

The vertical air ducts are usually rectangular tin flues built into the wall when the building is going up, sometimes they are only plastered, but round, smooth metal linings with close joints give much the best results. The cross section of an air duct should be comparatively large, as a large volume of warmed air with a slow velocity gives the best result.

There should be a separate vertical air duct for every outlet or register. In branched vertical air ducts, one is generally a failure.

The heated air from one heater, may be taken to two vertical air ducts, when they start directly over it, but one should not be taken from the top, and the other from the side; if so, the latter will be a total failure, unless the room to which the flue runs is exhausted; *i. e.*, the cold or vitiated air of the room is drawn out by a heated flue or otherwise.

Inlet or cold air ducts are best when there is one for every coil or heater; and its mouth or outer end, should face the same way as the room to be heated. By this means when the wind blows against that side of the house, the pressure is into the cold air duct, and materially assists the rarefied column of air, in the vertical duct, to force its way into the room.

Often the steam heater uses only one large branched cold air duct; but this system will give trouble unless all the rooms are exhausted.

A steam heater should not take a job of indirect heating unless the building has been arranged especially for it with some efficient system of flues, enough for a total change of air in a given time, say not to exceed one hour.

Ordinarily the architect makes no provision for drawing out the cold or depreciated air, other than an open fireplace, and often they make *no* outlet. Such a room cannot be warmed by indirect heating at all. But when there is a chimney, or an unwarmed outlet or foul air flue, the heated column of air in the vertical hot air flue is generally sufficient to force its way through. Very large rooms with high ceilings are difficult to warm by indirect heating.

A cheap and good way to draw, or exhaust, outlet or foul air flues, is to connect them all to one large annular flue, around the boiler chimney flue.

Warmed fresh air flues, should be in or near the outside walls, and should discharge near the windows; and foul air flues should be in the inner walls, and have an opening near the floor and ceiling, with register valves, to allow the occupant to use either or both as he thinks proper.

To find the time in *minutes*, it will take for a room of known cubical contents, to change its air through a flue of one square foot cross section: Multiply the velocity of the air through the flue in feet per second, by 60, and divide the result, into the cubical contents of the room in feet. Thus: Velocity of air 5 feet × 60 = 300 ÷ into cubical contents, say, 4,000=13·3 minutes.

To find the time for other sized flues, multiply the result by the cross section of flues in square feet or fractions thereof.

The velocity of the air in heating flues with only a natural draught, rarely reaches 8 feet per second, no matter what the conditions; and 2 feet, 4 5 feet, and 6 2 feet respectively, being fair averages of velocities for first, second, and third floors of a house.

Direct-indirect radiation embraces all heating surfaces placed within or partly, within the room to be warmed, *in direct connection with some system of ventilation.*

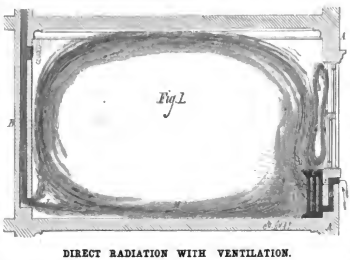
Heaters of this class are usually placed on the outside walls or under windows, following the same general rules as direct radiation, excepting the clusters are deeper, so as to prevent the cold air from rushing through without being warmed.

Fig. 1 shows a much used modification of this style of heating. It is a section of a room showing the action of the currents of air. A A, outside wall; B, partition wall; C, radiator; D, inlet flue; E, damper or valve; F, ventilating flue or foul air outlet; G, fresh air mixing with the air of the room; H, air of the room passing along the floor to the heater; I, a percentage of the air in the room passing off by the ventilator.

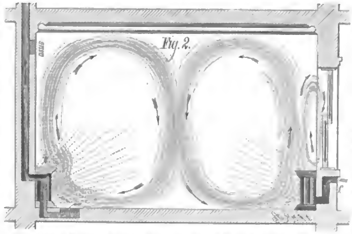
Fig. 2 shows another modification of direct-indirect radiation, where some of the *local heat* is employed to exhaust or draw out the vitiated air of the room. The arrows show the action of the air currents. A is a section of a radiator built with a sheet iron flue, B, between the tubes, and passing through a hole, cored in the base, which connects with the register in the floor, and a foul air flue, in the wall.

Some of the radiant heat, etc., from the radiator, A, warms the sheet iron flue, B, which in turn warms the air within it, causing an acceleration of the current in the foul air flue, and consequently drawing an equal amount of fresh air in at the opening, C.

There is this further distinction between the three systems of radiation: Direct radiation warms only the air of the room and maintains the heat. Indirect heating warms only the air that passes in and cannot warm the same air twice, and consequently has to raise the temperature of all the air that passes, from what it is outside, to what is necessary to maintain the temperature of the room, and make up for the loss by ventilation. Direct-indirect radiation warms part of the air over again, and warms all the air there is admitted for ventilation, which latter can be varied to suit the occupants.



DIRECT RADIATION WITH VENTILATION.



MODIFICATION OF DIRECT-INDIRECT RADIATION.

NEW INVENTIONS.

Mr. Ole C. Nuubson, of Mount Horeb, Wis., has patented an improved milk cooler, which consists in a milk cooler with trough, gauges, and faucets, and divided into separate chambers by a diaphragm whose central tube extends through the cover.

Mr. Chas. V. Richards, of Skowhegan, Me., has invented an improved clasp, which consists in a case having its edges so arranged as to form jaws, between which a flanged finger piece is pivoted. A wire loop or tongue is adapted to pass through a slot in the case, and has its ends passed through the flanges of the finger piece.

An improved buckle shield, patented by Mr. David Mosman, of New Britain, Conn., consists of a metal plate with curved ends provided with transverse slots and arranged over the buckle, the object being to ornament the harness and to prevent the horse's tail and mane from catching in the buckle.

An improved lubricator, patented by Mr. Oscar A. Rollins, of Campello, Mass., relates to the class of oil pumps designed for supplying oil for lubricating purposes to steam engine cylinders. It consists of an oil forcing piston driven with a intermittent motion by connection with some of the moving parts of the engine.

Mr. John F. Curtice, of Fort Wayne, Ind., has patented an improved device for heating sad irons upon the top of a stove. The invention consists in an improved sad iron heater formed of an open bottomed box divided into compartments by vertical partitions, having the middle part of its top stationary and provided with a handle, and the side parts of its top inclined and formed of doors shutting air tight, or nearly so, and provided with spring catches, to adapt the device for use in heating sad irons upon the top of an ordinary stove.

Mr. Henry S. Kratz, of Chicago, Ill., has patented an improved shelf for attachment to stovepipes for the purpose of supporting culinary vessels, dishes, clothes, or other things requiring to be kept warm or dried.

An improved road-scraper, patented by Mr. Samuel H. Dudley, of Bantam Falls, Conn., consists in the combination of guard bars having their upper ends bent forward at right angles to fit into the notches in the upper edge of the plank, and having sockets formed in their lower parts to receive the rear ends of the draw rods, with the plank, the draw rods and the staples of a scraper.

Mr. Charles A. Gale, of Piqua, Ohio, has patented an improved apparatus for taking solar prints from negatives. The invention consists in the combination of the two frames, hinged to each other at one edge, and provided at the other edge with a bolt and hand nut or equivalent clamp.

Mr. Antoine B. Dembrun, of New Orleans, La., has invented an improved furnace for cooking and baking, and various other uses. It consists in the combination of a furnace, an iron basket, and a hinged grate to form a compact, convenient, and portable furnace.

Messrs. Cornelius Bennett and Parker Burnham, of Silver City, Territory of New Mexico, have patented an improved apparatus for separating gold and other metals from dirt and sediment by what is known as the "dry" process. The invention consists in a combination of devices which cannot be explained without engravings.

Cost and Results of Some Recent English Strikes.

A writer in *Fraser's Magazine* estimates that the engineers' strike, which began in February last and continued about 33 weeks, caused a loss of $70,000 to the strikers. The average number of men out of employment during this time was 500. If no strike had taken place, their wages would have amounted to $144,000. But they received from society funds about $74,000, reducing their personal loss to $70,000. Of notable strikes that have taken place within the last two years, that of the London masons, which lasted 33 weeks and threw 1,700 men out of employment, cost the strikers about $130,000. The carpenters' strike in Manchester involved about the same number of men, and cost nearly as much. The strike and lockout of the boiler makers and iron shipbuilders on the Clyde cost the society upward of $65,000, the estimated losses being $1,500,000. The losses of the miners in the Durham strike are estimated at $1,200,000. In the above strikes, excepting that of the engineers first mentioned, the strikers suffered disastrous defeats. While strikes are exceedingly expensive luxuries to the men, even when successful, the writer above cited maintains that the number of strikes from which the employes reap no advantage are extremely few, as compared with those from which they derive some benefit, proximate or remote. In illustration of what is sometimes gained by the strikers, he cites the builders' strike and lockout in London in 1859. About 24,000 men quit work, but many of these obtained employment elsewhere. The number engaged in the struggle was from 6,000 to 10,000. The whole number interested in the result of the contest was between 40,000 and 50,000. After spending upward of $250,000, besides the loss in wages, the men were compelled to yield. But they gained the Saturday half holiday, which is now enjoyed by not fewer than 100,000 building operatives. This is computed to be a gain to the men of about $2,800,000 a year, "if not in money, at least in money's worth." The writer claims that the employes get over their losses much more speedily than the employers. With the former, he says, it is a matter of temporary inconvenience, or, at most, of present suffering only; with the latter it means not merely a derangement of business for the time being, but in many cases future embarrassment, if not failure.

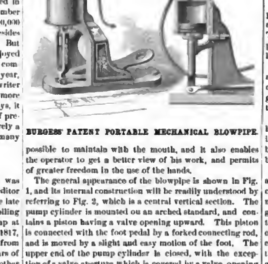
The First American Rolling Mill.

Mr. Thomas C. Lewis, of Portsmouth, Ohio, who was formerly an iron roll maker, in a recent letter to the editor of the SCIENTIFIC AMERICAN, states that his father, the late Thomas C. Lewis, was the maker of the first iron rolling machine erected in this country. This mill was put up at Middletown, Pa., 45 miles east of Pittsburg, in the year 1817, for the owners, Mason & Co. Mr. Lewis, Sr., came from Wales in 1815, when our informant was thirteen years of age. Our correspondent thinks that himself and his brother are the only persons now living who witnessed the making of the first bar of American rolled iron. This was the inauguration of what is now one of our most important branches of industry.

NOVEL PEDO-MOTOR.

The annexed engraving represents a new device for accelerating the motion of walking. It seems to occupy an intermediate position between the roller skate and the velocipede.

The invention consists of a frame supported on three wheels, two of which are small and employed only in supporting the main frame of the device, while the third and larger one is used both as a supporter of the frame and a driver of the machine. All of the wheels are furnished with rubber tires, and the larger one is fixed to a shaft extending across the frame and carrying a ratchet, also a loose pinion provided with a pawl capable of engaging the ratchet. A foot pedal is pivoted to the upper part of the pedo-motor frame, and carries a segment rack which engages the loose pinion on the drive wheel shaft. When the toe of the foot pedal is depressed the segment rack, by its engagement with the pinion, turns the drive wheel and propels the machine forward. The motion of the foot necessary to impart a rotary motion to the drive wheel is exactly the same as that of the ordinary act of walking. For checking the motion of the pedo-motor a brake is provided, which is made to press upon one of the smaller wheels by pulling a wire or cord, which extends upward, and is provided with a hook or loop for attachment to some part of the clothing of the user. The pedo-motor is the invention of Mr. Richard Gornall, of Baltimore, Maryland.



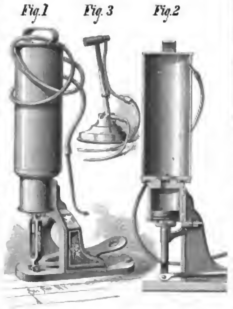
GORNALL'S PEDO-MOTOR.

New Preservative against Scurvy.

In reporting the reception of Prof. Nordenskjöld and the staff of the Vega at Nagasaki, the correspondent of the *North China Herald* notes that there was not a single case of scurvy during the whole voyage. This, he learns, was owing to the free use of a curious little berry that springs out of the eternal ice and snow during the short summer; it bears profusely, and has a taste like the raspberry, but more acid. The fruit is dried, and then mixed with the milk of the reindeer, and it can be carried in a frozen state for thousands of miles. There was also used a curious kind of food made from the whale's hide, which is pickled and eaten freely during the winter.

IMPROVED BLOWPIPE.

The annexed engraving represents a compact, simple, and efficient device for maintaining a continuous supply of air under light or heavy pressure for blowpipe use. The advantages of an invention of this character will be readily admitted by any one having had experience with the ordinary mouth blowpipe, as it not only saves a great amount of hard labor, but it delivers a steadier and stronger blast than it is



BURGESS' PATENT PORTABLE MECHANICAL BLOWPIPE.

possible to maintain with the mouth, and it also enables the operator to get a better view of his work, and permits of greater freedom in the use of the hands.

The general appearance of the blowpipe is shown in Fig. 1, and its internal construction will be readily understood by referring to Fig. 2, which is a central vertical section. The pump cylinder is mounted on an arched standard, and contains a piston having a valve opening upward. This piston is connected with the foot pedal by a forked connecting rod, and is moved by a slight and easy motion of the foot. The upper end of the pump cylinder is closed, with the exception of a valve aperture, which is covered by a valve, opening upward into a cylindrical air reservoir secured to the upper end of the pump. Near the top of the air reservoir there is a nipple, to which is attached a flexible tube communicating with the blowpipe.

The manufacturers furnish either the ordinary blowpipe or the compound blowpipe, represented by Fig. 3. The machine is light and portable, weighing but twelve pounds and measuring twenty-four inches in height. The pump cylinder is two and a half inches in diameter with three inch stroke.

This device will be invaluable to a large class of artisans, and especially useful to dentists, jewelers, chemists, assayers, metal workers, miners, and others who desire a strong steady blast for reducing, fusing, soldering, etc. It may be used to advantage in connection with the small melting furnaces now so largely in use. It is also of great utility to machinists and steam, water, and gaspipe fitters in making alterations and repairs, as it admits of the local application of a strong heat, and thus obviates the necessity of removing the parts. The blowpipe may be used effectively in connection with a gas, alcohol, or oil flame.

The pipe outlet is much smaller than in the mouth blowpipe, to permit of maintaining a pressure which may be increased or diminished by a quick or slow motion of the treadle. The air chamber is easily filled, and when charged affords a *constant* supply of pure air. It is claimed by the manufacturers of this blowpipe that the pump possesses many advantages over the bellows or bladder, as a pressure of many pounds is readily sustained with but little exertion.

Further particulars may be obtained from J. Elliott Shaw, No. 154 South Fourth street, Philadelphia, Pa.

MECHANICAL INVENTIONS.

Mr. George Stewart, of High Point, N. C., has patented an improved spark arrester. This is an improvement in the class of smoke stacks in which the ascending sparks and cinders are diverted laterally by an inverted cone and strike upon inclined flanges or wings, whereby they are extinguished and pulverized before escaping from the stack.

An improved drilling machine has been patented by Messrs. Nicholas Remmel and Mathias Remmel, of Kewaskum, Wis., for operating drills for drilling holes in metal, and also for holding auger bits and other tools for boring wood. It consists in a drill stock connected with a shaft rotated by a crank or band wheel and gearing and held in a stationary frame, and in a device for feeding the work to the drill by means of a table placed on a shaft held in vertical guides and connected by levers with a treadle.

Mr. Elias A. Wible, of Folsom, Cal., has patented an improved vehicle axle formed of a socketed tube and a wooden stick, in combination with an interposed layer of rubber. There is a hole leading through the axle to the shaft, and provided with a case, a cup, and a screw, for the purpose of lubrication.

Mr. Gustave Wedel, of San Francisco, Cal., has patented an improvement in the class of binders for folios, or a series of detached leaves; it consists of metal strips doubled longitudinally to form lips or clamping edges, between which the leaves are secured.

Mr. John Kenmuir, of St. Joseph, Mo., has invented an improved twelve bells striker for clocks, the object of which is to furnish a clock for use in Masonic lodges, which shall be so constructed that it may be made to strike twelve low bells whenever desired, which will strike at no other time.

Mr. William W. Mackey, of Galion, O., has patented an adjustable gauge for cutting bevels for miter joints with a circular saw, and for cutting them on opposite ends of the moulding without changing the gauge. It consists of two gauges pivoted at one end to the sliding bed on the side next to the saw, and having the opposite ends pivoted to levers or arms having longitudinal slots, which are crossed and secured together and to the bed by a set screw passed through the slots at the junction. These arms are designed to be graduated so as to permit the gauges to be set readily at any desired angle to the saw.

Mr. Richard Cotter, of Virginia City, Nev., has patented a machine for tarring flat and round wire ropes, which is so constructed as to coat the ropes thoroughly with tar, force the tar into the crevices of the ropes, remove the surplus tar, and prevent it from running down the ropes.

Mr. Warren H. Guthrie, of Florence, N. J., has patented an improved screwdriver having a jaw on each side of the blade, the two jaws being connected by a right and left thumbscrew passed through a slot in the blade, whereby the ends of the jaws can be moved to and from the blade, and thus adapted to clasp screw heads of various sizes.

Messrs. William F. Flanagin and Daniel A. Sager, of Pine Wood, Tenn., have patented an improved automatic let-off mechanism for looms, for letting off the yarn from the yarn beam at a uniform speed from the first to the last end of the warp, the speed of the yarn beam being increased in proportion to the decrease of the yarn on the beam.

Mr. Ansel T. Green, of Minneapolis, Minn., has patented an improved belt stretcher. It consists in fixing gear wheels on the heads of the two long side screws of the stretcher, and in arranging two corresponding pinions on a crank rod in such a manner that when the pinions are thrown in gear with the gear wheels both screws will be worked simultaneously; and it further consists of a graduated clamp for the more accurate adjustment of the sides of the belt, of hinged screw sockets for the quicker attachment and removal of the stretcher, and of a thumbscrew nut of novel construction.

Messrs. Jabez C. Terry and Herbert J. Terry, of Springfield, Mass., have patented an improved button lathe designed for turning buttons into finished shape from blanks previously prepared; and instead of operating upon the principle of a cutter formed to suit the pattern of button, it employs a single cutting tool, which, by a variety of adjustments, that may be effected either by hand or automatically, permits the button to be turned and finished according to any desired pattern.

The same inventors have also patented an arrangement of revolving gripes for holding the stock, which are held normally together by spring pressure, but have a treadle connection for separating or retracting them, and a cutter head revolving in a plane at right angles to the plane of revolution of the gripes, or parallel with the axis of the latter, which cutter head is combined also with a treadle connection for causing the cutter head to approach the axis of the gripes at the will of the operator.

The New Copying Process.

We have heretofore given full directions for the working of this process, which is thus described by Mr. R. H. Ridout in *Nature*:

A very elegant process has recently been introduced into this country for copying and multiplying letters and documents. It is known by various names, according to the etymological skill of the makers. One calls it a "hektograph," another less pardonably calls it the "centograph," while yet another, to bridge the gap between ancient Greek and modern English, styles it the "printograph." But whether it is introduced by these names, or the polygraph, the compo lithograph, or the velocograph, the principle is the same, though the details are slightly varied in each case. A slab of gelatinous material in a shallow tin tray forms the type. The letter is written with a special ink on any kind of paper, and when dry is placed face downwards upon the jelly, and allowed to remain a minute or more. On removal it is found that the greater part of the ink has been left behind on the jelly. It is only necessary to place pieces of paper on the latter, and on their removal they are found to be perfect facsimiles of the original copy. The number of copies obtainable varies with the ink, the most potent being aniline violet, such as Poirrier's. With this a hundred copies may be produced. Others, such as bleu de Lyon, Bismarck brown, or Roseine,* yield forty to fifty. It was with a view to determine the principles which govern this beautiful process, that I made an examination of the subject. The slab consists of gelatine and glycerine, with carbolic or salicylic acid to prevent fungoid growth, and in the "chromograph" a quantity of barium sulphate is added, which gives the slab a white, enamel-like appearance.

If a hot, strong solution of gelatine in water be prepared † and then a certain quantity of glycerine stirred in, the whole mass will become solid in cooling. This might at first sight appear to be a solution of gelatine in water and glycerine; but such is not the case, the gelatine being quite insoluble in glycerine. When the aqueous solution solidifies, the gelatine still retains the water, but the large quantity of glycerine being dispersed through the mass makes the whole into what is practically *a very fine gelatine sponge containing glycerine in its pores.*

The moisture-loving nature of the glycerine prevents the "sponge" from getting dry, while the insolubility of the gelatine in the glycerine prevents its becoming liquid. When the copy is placed on the jelly, the glycerine comes out to meet the ink, for which it has an intense liking. All the suitable inks are freely soluble in glycerine. Some, too, contain acetic acid either in the free state or in combination with bases, as in rosaniline acetate. The acetic acid exerts a solvent action on the gelatine, so that it will be found that after taking off some impressions with an acetic acid ink, as the "multiplex," the jelly will be etched wherever the ink has come into contact with it. As long as any ink remains on the jelly the glycerine will come out of the pores to keep it moist, but when the whole of the ink has been removed the flow of glycerine ceases, and the parts become quite dry. If the ink is not entirely removed by taking a sufficient number of impressions, and the jelly left, after a lapse of twenty-four hours the remaining ink will be absorbed by the jelly. It is necessary, therefore, that the copies should be taken off as soon as possible, so as to avoid the defect caused by the spreading of the ink.

Most of the makers suggest that directly the slab is done with the type should be washed off. The hektograph and most others require that the water should be warm, but the finely divided barium sulphate in the chromograph renders the surface less tenacious, and the impression may be removed with cold water.

Where practicable, it is better in all cases to leave the slab for twenty-four hours, when the old impression will be quite absorbed, and not interfere with a new one.

This gelatine copying process has been received with so much favor by the public that it shows there is a great want for some rapid means of getting a limited number of copies of letters, etc.; and seeing that any number of colors may be used in the original drawing, Mr. Norman Lockyer has suggested that it would be of much use in laboratories for the multiplication of original sketches of biological specimens, and even for spectra charts, and so save much of the time spent in making duplicate copies. The gelatine slab cannot be said to be perfect, as it is liable to be affected by atmospheric changes; but, bearing in mind the fact that the whole is simply a sponge filled with a compound capable of liquefying certain inks, it is reasonable to hope and expect that chromography is only the pioneer of a process which shall possess all its advantages and none of its defects.

The Fire Laws of Japan.

The severity with which persons in Japan are punished who have the misfortune to be burned out is stated as follows: If the house is unoccupied and is accidentally set on fire, the person through whose carelessness the fire is started receives ten days' imprisonment with hard labor; if it is inhabited and the fire be produced by the proprietor, then he is punished with twenty days; if the fire spreads to other houses the sentence is forty days, and when anybody is killed thereby, one degree heavier; but if the person killed is a relative of the first degree, the punishment is one hundred days; if the house belongs to the government, one hundred days, if a temple, from sixty days to one year, but ten years are inflicted if it happens to be one of the great temples of Isle, or in the precincts of the Imperial Palace. If a robber sets fire unintentionally to a house, he is punished with, at least, three years' imprisonment with hard labor. Decapitation awaits incendiaries, ten years' penal servitude an attempt at arson; the punishment being mitigated if the would-be incendiary is a servant who has just received a sharp rebuke, or if the attempt be made on an uninhabited dwelling. If a man sets fire to his own house, ninety days, but if the fire spreads to houses in the neighborhood, two years and a half; and penal servitude for life is inflicted if the offender profits by the opportunity of the fire to purloin goods or property.

* A very potent and easily prepared ink which will yield a hundred copies may be made by dissolving rosaniline in a cold saturated solution of oxalic acid. It must be allowed to dry spontaneously.

† 4 oz. gelatine dissolved in 6 oz. water, and 20 oz. glycerine, sp. gr. 1·25, previously warmed, stirred in. Any air bubbles in the gelatine are removed before the addition of the glycerine. A cheaper compound, which answers equally well, but is rather darker, consists of Scotch glue, 6 oz.; water, 6 oz.; glycerine, 20 oz. These quantities make a slab 10 × 13 × ¾.

IMPROVED DRAUGHT TUG SPRINGS.

The accompanying engravings show two forms of draught tug springs patented by Mr. R. W. Smalley, of Salem, Mass. These springs are intended to relieve the horse from sudden jerks and strains in drawing a load over a rough road, and also in starting heavy freights, saving a great percentage of power and often preventing the horse from balking.

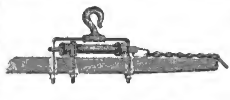


Fig. 2.—SMALLEY'S DRAUGHT TUG SPRINGS.

Fig. 1 shows the device, with a portion of the spring case broken away to show the internal construction. Fig. 2 shows the application of the device to short tugs, such as are commonly used on drays. The invention consists in a barrel or spring casing, having at one end a hook, and containing a strong, double steel spring which surrounds a rod extending through the end or the casing opposite the hook. This spring presses against a nut and washer on the inner end of the rod. When the springs are used in connection with traces, the hooks engage the ends of the whiffletrees, and the opposite ends are secured to the traces. When the springs are used in connection with short traces or chains they are arranged as shown in Fig. 2; the iron staple being made high enough to allow the back-chain hook to move freely.

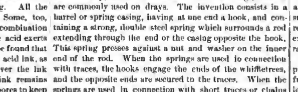
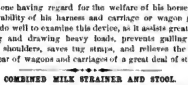


Fig. 1.—SMALLEY'S DRAUGHT TUG SPRINGS.

Any one having regard for the welfare of his horses, or the durability of his harness and carriage or wagon gear, would do well to examine this device, as it assists greatly in starting and drawing heavy loads, prevents galling the horse's shoulders, saves tug straps, and relieves the running gear of wagons and carriages of a great deal of strain.

COMBINED MILK STRAINER AND STOOL.

The accompanying engraving represents a combined milk strainer and stool invented by Mr. G. B. Valentine, of Shepardsville, Clinton county, Mich. The design of the invention will be at once understood by reference to the engraving. The milk pail is provided with a cover which excludes dirt and dust, and at the same time converts the pail into a stool for the milker. A tube extending from the pail cover supports a strainer which receives the milk as it is drawn from the cow and prevents the entrance of dirt or dust to the pail, and the milk is conveyed to the pail in a clean and wholesome condition. The accidental overturning of the pail, so common in the ordinary methods of milking, is not likely to occur when this device is used.



VALENTINE'S MILK STRAINER AND STOOL.

MISCELLANEOUS INVENTIONS.

An improvement in horse powers, patented by Messrs. Elijah Wade and William McAulay, of Quitman, Ga., consists in a novel arrangement of a tongue and double tree, in combination with the sweep or lever of a horse power, whereby greater leverage may be obtained within a given circle.

An improved tire fastening for vehicle wheels has been patented by Mr. Chauncey H. Starkey, of Colorado Springs, Col. The object of this invention is to provide a simple and effective means for fastening the tires and fellies of vehicle wheels together, so that the tire will not slip off from the contraction of the wood. This dislocation of the tire is of frequent occurrence, and as it generally results in the breakage of the wheel, it is a very serious difficulty, and is especially embarrassing when it happens to loaded wagons in the western country, where opportunity for repairs exist only at long intervals.

An improvement in advertising frames, patented by Mr. Emory J. Morrell, of Petrolia, Ontario, Canada, consists of a center post or standard, on which are set two broad collars, one below the other, from which radiate arms that support on their forward ends upright boxes, the faces of which are each of them divided by vertical strips into three sections, provided with glass fronts, through which may be seen the business cards, etc., that are placed within. Over each column or section will be placed the name of the business represented by the cards below.

An improved road scraper, patented by Mr. Samuel H. Dudley, of Bantam Falls, Conn., consists in the combination of guard bars having their upper ends bent forward at right angles to fit into the notches in the upper edge of the plank, and having sockets formed in their lower parts to receive the rear ends of the draw rods, with the plank, the draw rods, and the staples of a scraper.

Mr. Alfred R. Garver and Haney Hemenway, of Colorado Springs, have patented an improved wire-stretcher, which consists in combining a spring having a pawl and a T-lever with ratchet on the spool, and in combining with a frame having a slot at one end, and a median spool, a ribbon of metal, and a head, to connect the spool and gripers.

An improvement in grain separators has been patented by Mr. Alexander Fugel, of Clayton, Cal. The invention consists in a novel means for imparting motion to the upper and lower shoes of a grain separator.

Mr. William H. Allen, of New York city, has patented an apparatus for weighing grain, flour, and other similar substances as they flow from a spout into a hopper or other receiver. It is so constructed as to deliver the substance in exact and uniform quantities, and at the same time accurately register the quantities delivered.

Mr. George Wood, of Trenton, N. J., has patented a simple, convenient, and effective machine for removing corn from cobs. It is so designed as to take off the pulp and leave the hulls.

Mr. William T. Bradberry, of Allegheny, Pa., has patented an improved combined fire screen and blower, which, when the device is not in use as a blower, may be lowered and used as a fire screen.

Mr. John Decker, of Ogdensburg, N. J., has patented an improvement in burglar alarms, consisting of a sliding match carrier and a weight so arranged and connected with a door or window that when the door or window is opened the weight falls and gives a sufficient alarm, and at the same time causes a match to be lighted on a friction surface and to be moved to and light a lamp. The device may be connected in one or more windows or doors.

Messrs. Partrick J. Clark and Joseph Kintz, of West Meriden, Conn., have patented an improvement in extension chandeliers. This invention relates to chandeliers that are fitted with telescopic joints, so that the lower portion, carrying the burners, may be raised and lowered on a fixed rod attached to the ceiling.

Mr. Edward Edwards, of South Charleston, Ohio, has patented a strong, easy, and convenient seat or range of seats for halls, opera houses, etc., consisting of several upright side frames rigidly held by iron rods that support the seats. The seats have a strong bracing strip running across and secured to the hind legs.

Mr. Azell N. Roueche, of Bay City, Mich., has patented an improved cup, such as are used on billiard tables for holding chalk for application on the tips of billiard cues, the object being to make convenient the chalking of the cue without handling the chalk, and to keep the chalk and the cup from rattling and shaking at the concussion of the balls with the cushion of the table.

Mr. Marshall J. Hughes, of Jersey City, N. J., has patented an improved stereotype casting box. This is an important improvement, and dispenses with the spacing blocks previously employed, and clamps or secures the side bars at any desired distance apart very quickly and easily. It also permits of inserting or removing the mould with much less difficulty and labor and in a shorter time.

Messrs. Henry B. Andrews and Oscar W. Ball, of Faribault, Minn., have patented a machine for pressing the axle boxes into the hubs of wheels. It consists in the combination of a bed plate or frame, having a large hole or opening through its center, a detachable plate, having a hole through its center to receive the end of a hub, and stationary uprights, supporting a detachable crossbar having a lever, and the lever for pressing the box into the hub.

AMERICAN INDUSTRIES.—No. 30.

THE MANUFACTURE OF LEATHER BELTING.

The use of leather belts or bands for the transmission of power in driving heavy machinery is a comparatively modern innovation. It was a "Yankee idea," as the phrase goes, and this method of conveying power has been adopted in this country to a far greater extent than anywhere else in the world. In England, whose pre-eminence in nearly all branches of manufacture has always been so marked, the possibility of using leather belts to run heavy machinery was for a long time scouted, and it is only within a few years that some of the largest mill owners there have practically conceded the advantages of this method. To run small machines, where but little power was required, bands made of different substances had long been used, but where a great amount of power was to be employed, cog wheels or gearing was thought to be absolutely indispensable. It was expensive to fit up machinery to run with cogs and gearing; there were many breakages, involving interruption to work as well as costly repairs, and a great amount of power was always lost in friction; but it had become a fundamental idea of the English mechanic that this was the only "sure" method of conveying power in a large way. We have even known of instances, within the past ten years, where owners of extensive factories in England could not believe it possible that machinery requiring as much as 300 horse power could be run without the use of cog wheels or gearing, until the driving power had been several times divided up, and have been witnesses of their astonishment at seeing one leather belt regularly transmit what was estimated as 800 to 1,000 horse power. A large portion of the manufacturers in England and on the Continent of Europe still use gearing for work in which its employment would not be for a moment thought of in this country, but its use is now rapidly giving way before the proved advantages of what may be truly called the American system.

The manufacture of leather belts as a distinct branch of business was first commenced about the year 1825, by a New York leather merchant, who occupied for that purpose the lofts of a store in Ferry street. Previous to that time it was customary for machinists to fit up their own belting, buying the leather in the side or whole hide, and cutting and joining the lengths. As the "stretch" had not been taken out of the leather, the belt so made would constantly need "taking up," and as the hide had not been especially selected for this purpose, and the makers generally knew but little of the differences in the quality of the leather in different portions of the hide, it was seldom that a belt would run true without twisting. When, however, a good mechanic, who had also a tanner's acquaintance with the differences in leather, undertook to manufacture belts, there was not only a wonderful improvement in their wear and the amount of work which small belts would do, but the first step was taken toward so extending their use that they could take the place of gearing in running heavy machinery. The business was of slow growth at first, however, and it was several years before the "ready made" belting came into general use.

Among the earliest to perceive the large field offered by this new specialty was Pliny Jewell, of Hartford, Conn., the founder of the house of P. Jewell & Sons, whose extensive factory for the manufacture of belting furnishes the subject for the illustrations on the first page of to-day's paper. Mr. Jewell had been a tanner, but, in 1849, determined to commence the manufacture of leather belting, and in connection with his son Marshall, founded the house of P. Jewell & Son. Three other sons were afterward admitted—Pliny, Charles A., and Lyman B.—constituting the firm of P. Jewell & Sons, which style has since been maintained, although the father has been dead several years. Besides being energetic and thoroughly wide-awake business men, they were a family of tanners, and therefore had the best of preparation for making a success in what was then a comparatively new business. The use of leather belts rapidly increased, and the business was soon greatly enlarged, and it was only a short time before the goods manufactured by this house were to be found in the factories of every State in the Union. The firm have not been content to stop here, however, but for some years past they have exported and sold large quantities of belting to European mill owners, and the demand for belts of their manufacture, from the foreign as well as the home trade, is constantly increasing.

The belt factory of P. Jewell & Sons, at Hartford, is a five story building, 185 feet long by 44 feet wide, with an L three stories high. The leather from which the belts are made comes to the factory direct from a large tannery in Michigan owned and operated by the firm. The leather all comes "in the rough," as it is called, that is, it is only tanned and dried, but is in no way finished at the tannery. The first operation to which it is subjected after coming to the factory is the scouring, as shown in the upper right hand sketch. Thorough scouring is one of the indispensable requisites in good belt making, for by this operation the "bloom" from the bark liquors, with other coloring and resinous matters, not actually adding to the strength of the leather, are washed out. For this purpose the leather, having been thoroughly wet, is placed—either a whole or half hide, as may be desired, at a time—upon the movable bed of the scouring machine, which may be easily and quickly moved from side to side, or forward and backward, as necessary. Over this bed, and attached to an arm from a shaft, is a sort of box, in which are fixed scouring stones similar to those used by curriers. There are two of these stones, one in each side of the box, and as the arm moves forward one of them makes a stroke on the leather, while with the backward movement the other gives a similar stroke. These stones are accompanied by stiff brushes, a small jet of water being at the same time constantly directed to where the stoning and brushing are being done. The workman is all the time moving the table on which the leather is spread out, so that this scouring may be effected on every portion, and he can make the strokes of any desired force. This machine will do as much scouring as it would be possible for three or four men to do by hand, and it is thought to do the work far better for leather to be used in making belts, as the powerful strokes it gives are very effectual for the thorough "setting out," or smoothing of the leather, making it to lie flat and even.

The illustration to the left of the scouring room shows the workmen engaged in cutting up the leather, all wide belts being cut from the middle of a whole hide, and each width of belt having an especial part of the hide from which it is most desirable to cut it.

The "stretching," as shown in another sketch, is of especial importance in the making of a belt which is expected to run without giving trouble, for the necessity of having frequently to "take up" belts which stretch so as to become too loose is a serious inconvenience in a factory, where, oftentimes, a number of hands must stand idle until the difficulty is remedied. The stretching is accomplished by making fast each end of a piece of leather in clamps, then, with a lever, putting on all the strain which the leather will bear, and allowing it to stand under this strain for several hours. In this way the stretch is generally so well taken out that a new belt, where it has been properly put up, may often be run for months without requiring any attention.

The "jointing" and "cementing," as shown in another sketch, embrace departments of the business which formerly received very little attention, but are now recognized as of great importance. In the jointing, the ends having been made perfectly square, they are beveled and skived down, so that, where the laps occur, the belt shall be of an even and uniform thickness, and the fitting as nice and true as if the whole belt were cut out of one piece of leather. It is especially important that this work be well done, for the smoother the surface of the belt is made the less air will pass under it and between it and the pulley, and the closer the contact of the belt and pulley the more machinery will the belt drive. The cementing of these ends or laps together is said to contribute much more to the strength of the belt than the riveting, and we have seen tests of belting, in which only cement was used for fastening the different lengths, where the leather gave way at other places rather than where the joint was made.

The room devoted to riveting and finishing is shown in the large engraving at the bottom of the page, which gives a good idea of the extent of the business, and the methodical manner in which it is conducted.

It is impossible, however, to make good belts without having a first-rate selection of just the right kind of leather—to obtain which the hides should be selected and the tanning operation conducted with that end in view. The Messrs. Jewell have a large tannery in Michigan, with a capacity for tanning 50,000 hides a year, which they run for the especial purpose of giving them just the kind of leather they use in their belt factory. It is located where there is an abundance of bark, and where the choicest hides for belting are to be had, namely, those from the grass-fed prairie cattle. These hides are, as a rule, superior to those taken from the stall-fed cattle of the Eastern States, the fiber of the hide being more compact and solid, and making leather less liable to stretch than any other. The tanning process is not hurried, as it is in many cases with sole leather, and no hides are "worked in" which have any brands or cuts that would injure a belt. The best hides for this purpose are those from cattle four or five years old, as the hides of animals of that age have not been repeatedly stretched and shrunken, from changes in their condition, as is often the case with older ones, and the leather made from such hides is more likely to permanently remain straight. "I give it as my judgment, after thirty years of observation and experience," says the Hon. Marshall Jewell, from whom most of the above facts have been obtained, "that the best and cheapest belt in the world is one made from the hide of a four or five year old bullock that has been fed on grass, the hide being tanned thoroughly with bark, and a long time given to the process, and the belt then being run with the grain or hair side to the pulley."

It would be strange, however, in a business of such magnitude as the belt manufacture has now become, and which has attained its present proportions so recently, if there were not many competitors in the field now principally occupied by leather belting. India rubber and gutta percha, and canvas, or one of the former in combination with the latter, are extensively used in out-of-door work and in wheel pits, or where the belts are constantly exposed to water, and for such work they serve a good purpose. In Europe there is a great variety of cheap belts, one kind consisting of refuse pieces of leather wired together. Belting is also made there of a species of Helvetia leather, so little tanned that it is here called rawhide; it is light, strong, and tough, but stretches easily, and is not as serviceable as are belts made of bark-tanned leather. The rawhide belting occasionally used here has something of the same characteristics. Many attempts have also been made to utilize metal in the manufacture of belts, but none of them have thus far met with any considerable success. A belt of this kind was brought forward in Russia some years ago, consisting of a chain whose links were locked together by small rods. Mr. Jewell, while Minister to Russia from the United States, negotiated for the control of the patent for this country, and put some of this belting in use on his own machinery. It was found, however, that this chain belt never got through stretching; the links became flattened and wore into each other, so that the belt lengthened a little every day, and, during the year in which it was in operation here, it had to be "taken up" as often as once a week, to the great annoyance and inconvenience of all who were dependent on it in their work. On a visit last year to the factory where it was manufactured, in St. Petersburg, Mr. Jewell found that its use had been abandoned for the above reasons. Notwithstanding, therefore, all the efforts which have been and are being made to introduce other kinds of belting, experience has thus far proved that bark-tanned leather makes the best, and, for most purposes, the cheapest article furnished, when its perfect reliability and the amount of wear it will give are taken into consideration.

The Hon. Marshall Jewell.

Perhaps it is proper, in concluding this sketch of the leather belting manufacture, as conducted by one of the representative firms in that line of business, to give some of the principal facts in the life of the gentleman who is now at the head of the firm, who was in the house at its commencement, and who has, besides taking an active part in this way in the industrial progress of the country, filled several prominent positions in public life. Marshall Jewell was born in Winchester, N. H., October 23, 1825. For five generations back the Jewells had been tanners, and young Marshall, after receiving a common school education, supplemented by a few terms at the village academy, commenced learning his trade in his farther's tanyard. He afterward learned the business of currying, or the finishing of upper leather, and then, with the disposition for change so common with boys, drifted westward, and became engaged in the telegraph business, when that specialty was still in its infancy. He was for a while in the offices at Rochester, N. Y., Akron, O., Columbia, Tenn., and Jackson, Miss., and, in 1849, received an offer of the superintendency of the New York and Boston Telegraph Line, which he came North to accept. On reaching Hartford, however, he found his father started in the manufacture of belting, and, abandoning the telegraph business, cast in his fortunes with him. Mr. Jewell visited Europe in 1859 and in 1860, and again in 1865, when he spent a year abroad, visiting Asia and Africa; he also attended the French Exhibition of 1867, and in each of these visits he did good work, either in the way of extending the trade of his firm, or in gleaning information that would be of value in the prosecution of his tanning and belting business.

In 1868 Mr. Jewell's name was first brought forward in a political canvass, he was nominated for governor of Connecticut. Four times afterward he ran for the same office, during periods of great excitement and when the personal character of the nominees was subjected to the closest scrutiny, and was thrice elected, thus being successful in the race three times out of five in five successive years. In 1873, just after he had retired from the governorship, he was appointed United States Minister to St. Petersburg. While there he found that many fraudulent imitations of American manufactures were being sold, notably in sewing machines, Fairbanks' scales, Collins' axes, etc., all of which were being palmed off as of American make. He at once commenced negotiating a trade mark treaty with Russia, which was speedily concluded and ratified, by which American interests in goods covered by trade marks were protected. He also, at the especial suggestion of Mr. Jackson S. Schultz, made a careful investigation by which he discovered the process of making the peculiarly scented Russia leather, which had theretofore been made only in Russia, the means by which this particular odor was imparted to the leather having been kept secret. He found that the manufacture and coloring were carried on according to substantially the same principles as those followed here, but that the aroma was given to the leather by the use of a small amount of birch bark tar, some of which he purchased and sent to New York. Since that time American manufacturers have made "Russia" leather as good as any that was ever made in Russia; they have also made a good deal which was greatly inferior, but the poor as well as the good have had what is called the "genuine Russia smell," so that this no longer affords a criterion by which to judge of the quality of the leather or the place of its manufacture.

On the 1st of July, 1874, President Grant invited Mr. Jewell to return and take a place in his Cabinet as Postmaster General, which position he assumed on the 1st of September following. During his administration of the office, "straw" bidding, which had become a great evil in the department, was suppressed, and the general efficiency of the postal service was greatly increased. He also negotiated a postal treaty with Canada, whereby the postage between the two countries was made the same as between different offices at home. Mr. Jewell retired from the Cabinet July 14, 1876, since which time he has given his attention entirely to the business of his firm.

Notes on Belting.

We think it would be greatly to the advantage of mill-owners, dyers, finishers, etc., if everybody who supplied them with machinery and other goods would imitate more largely the example taken by Messrs. S. E. Morris & Co.,

as regards their belting, in giving precise instructions respecting the employment of such machinery or goods. Without holding ourselves responsible for the following notes on belting, we are glad to find space for them, as embodying the result of the experience of a firm who have had much to do in the matter. They say: The formula given below is based on the experience of engineers in Great Britain, America, and France. It serves the purpose of showing what width of belt will do the required work most efficiently, and at the same time last the maximum number of years. Many engineers, more especially in this country, are content to provide belts of greatly reduced width, and of single substance instead of double; hence the frequent complaints of their stretching, breaking, and lasting so short a time. As a matter of convenience and arrangement of machinery, a narrower belt than that which is shown by the generally accepted formula is often imperative; but, in the absence of any such conditions, it is questionable economy to depart materially from it. The following may be regarded as an axiom: To use a belt of ample width and substance for the work required is to secure for it a long existence, with satisfaction to all concerned.

Directions for Calculating the Width of Belts Required for Transmitting Different Numbers of Horse Power.

Multiply 33,000 by the number of horse power to be transmitted; divide the amount by the number of feet the belt is to run per minute; divide the quotient by the number of feet or parts of a foot in length of belt contact with smaller drum or pulley; divide this last quotient by six, and the result is the required width of a single tanned leather belt in inches.

Explanations.—The figures 33,000 represent the number of lb. a horse is reckoned to be able to raise one foot high in a minute. To obtain the number of feet a belt runs per minute, find the number of revolutions per minute of the driving shaft and multiply by the circumference of the drum, which is always 3·1416 its diameter. The final division by six is because half a pound raised one foot high per minute is allowed to each square inch of belting in contact with the pulley; a pound must therefore be allowed to two square inches, or six pounds to a strip one foot long and one inch broad.

Example.—Required the width of a single belt, the velocity of which is to be 1,500 feet per minute; it has to transmit 10 horse-power, the diameter of smaller drum being four feet, with five feet of its circumference in contact with belt:

$33{,}000 \times 10 = 330{,}000 \div 1{,}500 = 220 \div 5 = 44 \div 6 = 7\frac{1}{3}$ inches, the required width of belt.

Directions for Calculating the Number of Horse-power which a Belt will transmit.

Divide the number of square inches of belt in contact with the pulley by two; multiply this quotient by the velocity of the belt in feet per minute; again divide the total by 33,000, and the quotient is the number of horse power.

Explanations.—The early division by two is to obtain the number of lb. raised one foot high per minute, half a pound being allowed to each square inch of belting in contact with the pulley.

Example.—A six inch single belt is being moved with a velocity of 1,200 feet per minute, with four feet of its length in contact with a three foot drum. Required the horse power:

$6 \times 48 = 288 \div 2 = 144 \times 1{,}200 = 172{,}800 \div 33{,}000 =$ say $5\frac{1}{4}$ horse power.

It is safe to reckon that a double belt will do half as much work again as a single one. Belting made from "Helvetia" leather is much stronger and will bear a heavier strain than that made from ordinary tanned leather.

Hints to Users of Belting.

1. Horizontal, inclined, and long belts give a much better effect than vertical and short belts.

2. Short belts require to be tighter than long ones. A long belt working horizontally increases the grip by its own weight.

3. If there is *too* great a distance between the pulleys, the weight of the belt will produce a heavy sag, drawing so hard on the shaft as to cause great friction at the bearings; while at the same time the belt will have an unsteady, flapping motion, injurious to itself and to the machinery.

4. Care should be taken to let belts run free and easy, so as to prevent the tearing out of lace holes at the lap; it also prevents the rapid wear of the metal bearings.

5. It is asserted that the grain side of a belt put next to the pulley will drive 30 per cent. more than the flesh side. Experience can alone verify this; but when belts are required to be worked this way, the fact should be stated in the order, so that the riveting may be arranged accordingly.

6. To obtain a greater amount of power from belts, the pulleys may be covered with leather; this will allow the belts to be run very slack, and give 25 per cent. more durability.

7. Leather belts should be well protected against water and even loose steam or other moisture.

8. Belts working in very wet places should be ordered to be waterproofed.

9. A careful workman will see that his belts are redressed about every four months, by sponging the dirt from them with warm soap and water; then drying with a cloth, and, while still damp, rubbing in castor oil or currier's grease, which will be readily absorbed, the leather being moist from washing. Castor oil has the additional advantage of preventing rats attacking the leather.

10. In putting on a belt, be sure that the joints run with the pulleys, and not against them.

11. In punching a belt for lacing, it is desirable to use an oval punch; the larger diameter of the punch being parallel with the belt, so as to cut out as little of the effective section of the leather as possible.

12. Begin to lace in the center of the belt, and take care to keep the ends exactly in line and to lace both sides with equal tightness. The lacing should not be crossed on the side of the belt that runs next the pulley. Thin but strong laces only should be used.

13. It is desirable to locate the shafting and machinery so that belts shall run off from each other in opposite directions, as this arrangement will relieve the bearings from the friction that would result where the belts all pull one way on the shaft.

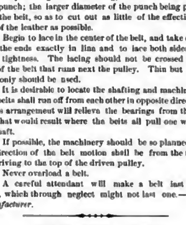
14. If possible, the machinery should be so planned that the direction of the belt motion shall be from the top of the driving to the top of the driven pulley.

15. Never overload a belt.

16. A careful attendant will make a belt last many years, which through neglect might not last one.—*Textile Manufacturer.*

NEW WEIGHTED HORSESHOE.

The annexed engraving represents an improved weighted



SEIXAS' WEIGHTED HORSESHOE.

horseshoe invented by Mr. Eugene E. Seixas, of Galveston, Texas. The improved horseshoe is designed to be used in training horses to trot rapidly by causing him to extend his strides. It squares his step, and may be used for preventing him from striking his knees with his feet.

In the engraving a part of the weight is broken away to show the form of the shoe under the joint, and Fig. 2 is a section of a portion of the shoe and weight taken through the joint. The weight is fitted to a rabbet or recess formed in the shoe, and is held in place by three screws, so that it may at any time be removed if required.

When it is necessary to use the device for preventing the horse from striking his knees with his feet the weight is made to extend farther back upon one side than the other, as shown in the dotted lines in Fig. 1.

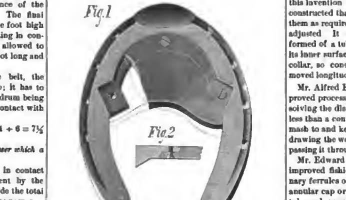
IMPROVEMENT IN FIREPLACES.

The annexed engraving represents an improved fireplace damper plate and arch bar recently patented by Mr. Clark Hanes, of Wheeling, West Va. It serves the purpose of an arch bar for sustaining the brick wall over the fireplace, opening also as a damper for regulating the draught and for preventing the falling of soot when the fireplace is not in use.

The engraving shows the plate and damper in position in the fireplace, and also gives a face view in perspective.

A is a cast iron plate of sufficient length to rest on the walls at the side of the fireplace, and having the oblong aperture, C, which is sufficient for the escape of smoke. A damper, B, fitted between two ribs on the plate, A, is capable of being moved so as to cover the opening, C. The plate is ribbed to give it sufficient strength to sustain the weight of the wall above the fireplace, and thus obviates the necessity of building an arch for that purpose.

This invention facilitates the construction of fireplaces, and renders them free from one of the principal objections brought against them, that is, the escape of soot through the flue opening into the room when the fireplace is not in use.



FIREPLACE DAMPER PLATE AND ARCH BAR.

RECENT INVENTIONS.

Mr. Solomon B. Ellithorp, of Rochester, N. Y., has invented an improvement in waxing mechanisms for sewing machines. It consists of two arms carrying sponges, which are moved reciprocally by the operating mechanism of the machine in such a manner that they pass over melted wax held in a suitable receptacle, taking up a suitable quantity thereof, and at the proper time are rubbed and clasped against the two threads carried by the needle and shuttle.

An improved cord adjuster has been patented by Mr. William W. Batchelder, of New York city. The object of this invention is to furnish cord adjusters and holders so constructed that cords may be moved longitudinally through them as required, and may be held securely in place when adjusted. It consists in a cord adjuster and holder formed of a tube having longitudinal flanges or ribs upon its inner surface, an interior swiveled spiral and a swiveled collar, so constructed and arranged that the cord may be moved longitudinally by turning the collar.

Mr. Alfred E. Feroe, of Tivoli, N. Y., has patented an improved process of obtaining wort, which consists in first dissolving the diastase of the ground malt in warm water at less than a converting temperature, and then bringing the mash to and keeping it at a converting heat by continuously drawing the wort from the bottom of the tub, heating, and passing it through the mash, as specified.

Mr. Edward Earle, of Brooklyn, N. Y., has patented an improved fishing rod which consists in providing the ordinary ferrules or tubes that are fitted to slip together with an annular cap or socket piece that covers the end of the outer tube and prevents water from working in and rotting the rod.

Mr. Charles J. Everickx, of Paris, France, has patented a system of articulation or joints for portable furniture, so that it can readily be folded up to occupy a very small space and can be conveniently carried.

New York City Fire Department.

The statistics of the Fire Department show that there were 1,541 fires in the city in 1879, against 1,655 in 1878. In 1877 there were 1,450. The only printed statistics with which these can be compared are those of the first three years of the existence of the paid department—1866, 1867, and 1868—when there were 798, 873, and 740 fires respectively. The increase in number of fires is accounted for by the increase of the city and the addition of such districts as Westchester to the area covered by the statistics. The higher efficiency of the Fire Department is indicated in the fact that while the percentages of total destruction of buildings by fire were 7, 6½, and 5 per cent for 1866, 1867, and 1868 respectively, the percentages for 1877, 1878, and 1879 were only 3·45, 1·14, and 1·8 per cent of total loss. This difference is said to be due to the perfected system of fire alarms now in use; the convenient arrangement of quarters for men and horses, insuring the promptest response to the signals, and the introduction into the city of a large number of new hydrants, which have always been erected as soon as the Commissioners requested them.

The principal causes of fires have been carelessness on the part of servants or occupants of houses (this is accountable for nearly one-quarter of all the fires), foul chimneys, explosion of kerosene lamps, and window curtains near gas jets. The number of fires from kerosene has been reduced from 136 in 1877 to 92 in 1879, by the methodical inspection of the oil offered for sale, and the regulation of its quality and of the quantity kept in store. Men are constantly employed in collecting samples, which are labeled and tested, and the dealer is attended to if his sample is below the standard fixed by law. The dealers are getting to understand that they cannot keep an inferior oil without detection, and the consequence is that there is seldom any offered for sale that is not of good quality.

THE MOHOLI GALAGO.

The moholi galago is nearly sixteen inches in length, inclusive of the tail. Its color is gray, with irregular markings of a deeper hue. The under parts of the body are nearly white, and the limbs are slightly tinged with a golden luster. The tail is not very bushy, excepting at the extremity, and its color is a chestnut brown. The texture of the fur is very soft, and there is a slight wooliness in its setting.

Nocturnal in habits, it sleeps during the day, with its large ears folded over the head in such a manner as to give it the aspect of an earless animal. More active than the loris, the moholi does not secure its prey by stealing on it with slow and silent movements, but leaps upon the flying insects on which it loves to feed, and seizes them in its slender paws. Besides insects, various fruits form part of the moholi's food, more especially such as are of a pulpy nature, and it is said that the moholi eats that vegetable exudation which is known by the name of gum senegal. Its diurnal repose is taken in the curious nest which it builds in the forked branches of trees, using grass, leaves, and other soft substances for the purpose. In this lofty cradle the young are nurtured until they are of an age to provide for themselves.

The face is full of expression, in which it is aided by the large and prominent ears; and the creature is said to contract its countenance into strange grimaces, after the fashion of the ordinary monkeys. Like the monkeys, too, it can leap for some little distance, and springs from one branch to another, or from tree to tree, with agility and precision. The moholi galago is an inhabitant of Southern Africa, having been found by Dr Smith hopping about the branches of the trees that bordered the Limpopo river, in twenty-five degrees of south latitude.

MOHOLI.—*Galago Moholi.*

SPIDER CRAB.

The body of this singular little crustacean is almost triangular, with a pointed protruding head. Notwithstanding its long slender legs it moves very slowly, never swimming, but crawling without touching its body to the ground. All kinds of sea tangle, plants, and sponges plant themselves on the backs of these crabs, sometimes completely enveloping them. These growths are so constant and so rapid that the creature can only free itself at the time when it changes its skin. This portable garden furnishes the crab with food which it gathers with its shear-like claws.

SPIDER CRAB.—*Stenorhynchus Longirostris.*

Hybrid Geese.

Mr. Charles Darwin communicates to the current number of *Nature* an interesting case, in which hybrid geese, the offspring of two distinct species, have proved quite fertile *inter se*. The common goose and the Chinese goose are so distinct that they have been placed in different genera or sub-genera; and yet they interbreed, and their offspring prove fertile. Mutual sterility is, therefore, shown to be no safe or immutable criterion of specific difference.

We have, however, says Mr. Darwin, much better evidence on this head, in the fact of two individuals of the same form of heterostyled plants (those in which the style varies in length in different flowers) which belong to the same species, yielding, when crossed, fewer seeds than the normal number, and the plants raised from such seeds being, in the case of *Lythrum salicaria*, as sterile as the most sterile hybrids.

Buried Oak Timber.

In deepening a river in the neighborhood of Norrköping, says the *Timber Trades Journal*, in order to make it accessible for ships of heavier draught, among several objects of interest brought up from the bottom, eight oak trees were found at a depth of seven feet under the old bottom. The bark was almost decayed, and when it was taken off the wood was found to be hard and black, resembling ebony. The trees are supposed to have been lying in the earth 900 years. The trees have been sold to a firm of joiners, who intend using them for cabinet work.

NATURAL HISTORY NOTES.

Insects Destroyed by Fungi.—Dr. Hagen, of Harvard University, in a paper on the destruction of obnoxious insects, after describing some experiments which had been made by Mr. J. H. Burns and others, draws the following conclusions: 1. That the common house fly is often killed by a fungus (*Sporendonema*), and that in epizootics a large number of insects are killed by the same vegetable parasite. 2. That the fungus of the house fly works as well as yeast for baking and brewing purposes. 3. That the application of yeast on insects produces in them a fungus which becomes fatal to insects. 4. That in the experiment made by Mr. Burns, all potato beetles sprinkled with diluted yeast died from the eighth to the twelfth day, and that the fungus was found in the vessels of the wings. He admits that further experiments are necessary to find out the most convenient method of application.

The Floating Fern.—One of the most widely disseminated tropical ferns is *Ceratopteris thalictroides*—a plant easily cultivated and propagated. Mr. Curtiss, in the *Botanical Gazette*, records the fact that he has collected fertile specimens of it in Florida. It appears to exist under widely different conditions, and it is very variable in size, and in the cutting of the fronds. Several of the forms have been described as species, and they are also cultivated under the generic name of *Parkeria*. Regarding the forms as belonging to one species, varying according to its habitat, it is generally dispersed in tropical and sub-tropical Asia, Africa, America, and Australia. Sometimes it grows in the muddy banks of rivers, in marshes, and other wet places, rooting in the ground. It is often found floating, however, like *Pistia* and *Azolla*. Mr. Curtiss found it floating free in water ten feet deep. Like some species of *Asplenium*, it propagates very freely from the buds which are abundantly produced on the fronds. Sometimes, as Wilson observed in Jamaica generally, the floating wild plants are much smaller than the cultivated ones, ranging less than six inches in height, including the fertile as well as the rosette of broad sterile fronds.

"Voice" in Fishes.—In a recent number of *Nature*, Mr. S. E. Pool gives an interesting account of an observation made by him in support of the claim that fishes are endowed with the faculty of voice. He stated that while engaged in a survey of the Disang River, in Eastern Asia, some six years ago, he had occasion to sound the depth of a pool. When seated in a small canoe and slowly nearing it, he suddenly became aware of the presence of a number of fishes called "mahsir." They were evidently attracted by the canoe, and Mr. Pool surmised that they might possibly think it a huge dead fish. While watching their movements he became aware of a peculiar "cluck" or percussive sound, which was frequently repeated on all sides, and coming from below, but near by. This was soon traced to the "mahsir," and one of them made distinct sounds which were answered by others. He states that in some parts of eastern Assam a large bivalve sings in concert with others.

The apparatus by means of which certain fishes are enabled to produce sounds has, according to the *Correspondance Scientifique*, been studied quite recently by a Danish naturalist, M. W. Sorensen. This gentleman, during his residence, in 1877 and 1878, at the point where the Riacho del Oro empties into the river Paraguay, discovered that the principal organ of sound was the swimming bladder. This, in the siluroids, is somewhat elastic throughout its whole length, while in the characins the elasticity depends especially on flat bands or round cords in its walls. The swimming bladder, as an organ, acquires its greatest development in the siluroids. In the species of the genera *Platystoma* and *Pseudaroides* it is divided by one longitudinal septum, and several transverse ones, into a few chambers or cells which communicate freely with each other. In the genus *Doras*, the swimming bladder has numerous appendages which are divided internally by incomplete septa, into a large number of small cells. In all these fishes the transverse apophyses of the first two or three vertebræ, and often a portion of the arch of the first vertebra, are not only joined together, but also with the posterior part of the cranium and the apophyses of the first vertebræ, by very strong elastic membranes. The transverse apophyses of the second and third vertebræ are in the form of very powerful springs, and are closely connected with the swimming bladder. The sound is produced by the action of muscles, which are inserted either directly on the swimming bladder or on the transverse apophysis of the third vertebra. In the characins, the elastic parts of the swimming bladder are stretched longitudinally by the contraction of the muscles, and the vibration which results from this rhythmical movement is transmitted to the air contained in the cavity of the bladder. In the siluroids, the anterior part of the bladder is drawn alternately backward and forward by the contraction and relaxation of the muscles; and during these movements the air, in passing through the incomplete transverse septa, sets the latter in vibration, and thus a sound is produced. The loudness of the sound emitted is in direct proportion to the velocity with which the springs vibrate. The fishes studied by M. Sorensen in connection with this subject belonged to the genera *Ageniosus*, *Doras*, *Platystoma*, *Prochilodus*, *Chalcinus*, and a few others.

An Open Winter and Spring Flowers.—At a meeting of the Torrey Botanical Club, on January 13, one of the members reported that he had found the liver leaf (*Hepatica triloba*) and the field chickweed (*Cerastium arvense*) in flower on the 11th of January of the present year, at Riverdale on the Hudson; and it was also stated by another member that the flower buds of the trailing arbutus gave evidence that

they would soon open if the present warm weather continued.

The Sagacity of Penguins.—In the report of M. E. Mouchez on the Transit of Venus Expedition to the Island of Saint Paul, now being issued by the French Academy, the author, in speaking of the habits of the penguins, as observed on that island, gives the following instance of their sagacity. When these birds, which are extremely awkward and slow in their movements and incapable of flight, come to a perpendicular wall of rock, and can find no way of passing around it, they prepare to scale it in the following manner: The first arrived squat down close to the base of the rocks, then those which follow press up closer and closer, and, climbing over the backs of the former, make, in their turn, a gradual series of short steps, over which the remainder pass. Unfortunately M. Mouchez neglects to inform us how the birds which form the bottom rounds of the ladder manage to get over!

The Utility to Flowers of their Beauty.—Mr. Darwin, in his "Origin of Species," says that "flowers rank among the most beautiful productions of nature, and they have become, through natural selection, beautiful, or rather conspicuous, in contrast with the greenness of the leaves, that they might be easily observed and visited by insects, so that their fertilization might be favored. I have come to this conclusion from finding it an invariable rule that when a flower is fertilized by the wind it never has a gayly-colored corolla. Again, several plants habitually produce two kinds of flowers—one kind open and colored, so as to attract insects; the other closed and not colored, destitute of nectar, and never visited by insects. We may safely conclude that if insects had never existed on the face of the earth, the vegetation would never have been decked with beautiful flowers, but would have produced only such poor flowers as are now borne by our firs, oaks, nut, and ash trees, by the grasses, by spinach, docks, and nettles." With this for his text, the Hon. Justice Fry, in an interesting article in the December number of the *Contemporary Review*, proceeds to discuss the facts bearing on the case, both such as have been observed by himself and by others, and arrives at the following conclusions: 1. That conspicuousness is a step toward fertilization in one mode, and might therefore well be used by an artist loving at once beauty and fertility. 2. That there is no such preponderating advantage in beauty as should convert the ugly wind fertilized flowers into the brilliant insect-fertilized flowers. 3. That in an infinite number of cases beauty exists, but without any relation to the mode of fertilization. 4. That it is maintained in many cases where the uglier and less beautiful plant is more useful, as in the case of the violet. 5. That even where conspicuousness is useful, it furnishes no complete account of the whole beauty of the flower.

As to the application of these facts to the two rival theories: If, on the one hand, nothing has become beautiful but through the utility of beauty, the latter will be found where it is useful and nowhere else. But investigations show that beauty is found where there is no utility; so the theory, in our present knowledge, is inadmissible. If, on the other hand, there be an artificer in Nature who loves at once utility and beauty, he may use the one sometimes as the mean to the other, or he may use beauty without utility; and the presence of beauty without utility is intelligible.

Peach Tree Borer Infesting Almonds.

During the past half dozen years the double white and pink almond shrubs growing in my garden have shown signs of being badly diseased. At first I thought little of it, as these shrubs are plentiful and multiply quite rapidly by suckers, but so many died outright that I was led to make a careful examination of their roots, and in these, and in the stems just below the surface, large numbers of the larva of the common peach tree borer (*Ægeria exitiosa*) were found. Peach trees being but little grown in my neighborhood the borers took to the almonds and here kept at work until few good plants are left.

Having quite a large number of the almonds, and seeing that the borers were well established, I concluded to leave them undisturbed in order to watch their progress during the summer, and ascertain if Harris was correct in saying that the moths appeared at all times from June until October. At various times during the summer I dug up almond plants, and invariably found grubs of all sizes, from those a few days old up to the nearly or quite full grown, but no pupæ were discovered under the bark or in the earth immediately surrounding the wood, a fact that leads me to believe that the grubs go a much greater distance from their burrows before passing into the pupa state than is generally supposed. Pupæ that are so frequently found in the gum exuding from peach trees are probably imprisoned there and cannot get away, else they would do so and find a more congenial place for passing through their final transformation. Harris states that the pupæ are found in the gum of peach trees; also under the bark and in the ground; but so far as my own observations extend I conclude that they will always seek the latter.

The old dwarf almond bushes in gardens are excellent breeding places for this insect, and it would be well for all who love such plants to examine them occasionally, and destroy all the grubs found. Peach trees may be protected with tar paper bands, but this is not practicable with such slender and free sucking plants as the dwarf flowering almond.—*A. S. F., American Entomologist.*

Saccharomyces Exiguus.

This variety of alcoholic ferment was identified by Rees, who met with it in the fermented juice of fruits. The cells are elongated and almost cylindrical in form, and are generally joined together so as to give a star-shaped appearance; their average length is 0·000118 inch, and their diameter only 0·000098; they are therefore much more minute than the ordinary yeast cells, and on this account are somewhat difficult to detect under the microscope; like all the other varieties of this species they multiply by budding and sporation. We are led to give these particulars of this form of ferment, says the *Brewers' Guardian*, in consequence of some recent researches of Muller and Hauer, which seem to prove that the deterioration of beer is largely due to the presence of this organism.

Some few years since Engel stated that the existence of *Saccharomyces exiguus* in beer ultimately produced a most unpleasant flavor, and these latest researches corroborate this view; we are now told that beer containing this ferment rapidly undergoes change; its brilliancy and pure flavor disappear, and soon becomes cloudy and acquires a greenish-gray tinge, and develops a most unpleasant taste and smell. It is, therefore, of the utmost importance that brewers should examine their seed yeast most carefully with a powerful microscope, in order that they may reject any samples which contain this most injurious ferment; its detection is not easy, on account of its extreme minuteness, but with practice the cells may be identified.

The Germs Floating in the Atmosphere.

An elaborate series of experiments has been undertaken by M. E. C. Hansen, at the Carlsberg Laboratory, with the object of identifying the various organisms which float about in the atmosphere, and which are found in worts and beer. These investigations form a valuable addition to those of Pasteur and Tyndall, who have already placed on record the results of their experiments in the same direction. It has been observed that the germs of yeast proper are very seldom met with in the atmosphere, but an infinite variety of moulds abound in almost all parts. Pasteur found that besides moulds and bacteria, he occasionally met with the following organisms: *Mucor racemosus, Saccharomyces mycoderma, S. pastorianus, S. ellipsoideus, S. apiculatus, S. cerevisiæ*, and bacteria, producing butyric and lactic acids.

M. Hansen found in his experiments that saccharomyces are very seldom met with in the atmosphere; bacteria are usually present, but they are not nearly so plentiful as the various kinds of moulds, among which *Penicillium glaucum* is the most common. In very cold weather it was noticed that all varieties of saccharomyces disappeared, but even then moulds and certain forms of micro-bacteria were to be met with.

One Year's Production of Petroleum.

The petroleum business during the year just closed has been marked by many results never before attained. The enormous production of crude (nearly 20,000,000 barrels) exceeded the production of any previous year by about 5,000,000 barrels. The average price of crude at the wells for the year was 94¾ cents per barrel, being 39⅝ cents less than for the year 1874, which has been heretofore considered the "cheap oil year."

The number of wells drilled during the year was 3,068, which number was not greatly in excess of former years; only about 6¼ per cent of the wells completed proved to be dry or worthless, against 11¾ per cent of dry holes developed in 1878. The shipments out of the producing regions have been larger than in any previous year, amounting to nearly 16,000,000 barrels, which exceeded the shipments of 1878 nearly two and a quarter million barrels. The accumulation of stock in the producing regions of Pennsylvania during the year has been without a parallel in the history of the trade; the amount of stock January 1, 1879, was 4,615,299 barrels, and on January 1, 1880, 8,470,490 barrels, being an increase of 3,855,191 barrels in 1879.

The great Northern, or Bradford district, has contributed largely to these results; in fact for the last two years this field has been the chief point of interest in the oil country, where most of the operators have congregated and most of the developments have taken place. In the last five years there have been about 6,000 wells drilled, 5,100 of which are now producing oil at the rate of about 45,000 barrels per day. The total production in that district from August, 1875, to December 31, 1879, was 21,091,544 barrels, and the shipments out were 15,771,314 barrels, leaving a stock in tanks of about six and a quarter million of barrels. The exports of petroleum for the year have been unprecedentedly large, exceeding all former years by many million gallons. The stocks held in European ports are also quite large, exceeding the amount held at the same time in 1878 some 500,000 barrels.

The maximum production of crude petroleum in the Pennsylvania oil fields was reached in August, 1879. Since that time the production has undoubtedly been steadily on the decline, and from present indications we may look for a continued decline, slowly but surely, until some new and now unknown field shall be found which shall yield the precious fluid bountifully.

There was a steady increase of stock at the wells during the first eight months of the year, which was not reported and did not go into the account in making up productions and stocks. The pipe lines prior to September did not take from the wells their production, which was evident from the overflowing tanks everywhere to be seen in the Bradford district. Since the month of August the wells have not only been relieved, but the lines have been taking all the production and steadily drawing on well stock. The month of December shows that the stock at the wells has been depleted about 180,250 barrels, which we have credited to productions and stock by distributing 750 barrels a day through the first eight months of the year.—*Stowell's Reporter.*

Fluid for Preserving Organic Substances.

M. Wickersheimer, of the University of Berlin, has invented a fluid for the preparation of animal and vegetable tissues, which surpasses anything before known in its power of preserving the color, form, and elasticity of specimens treated with it.

The fluid may be injected into the veins of the body to be preserved by it, or the entire object may be immersed in it. In either case the elasticity of the tissues and the flexibility of the joints are preserved.

At a recent meeting of the Philadelphia Academy of Natural Sciences, Professor Barbeck described a number of skeletons, which showed beautifully the combined movements of the chest, larynx, and other parts engaged in the mechanism of breathing. Several skeletons of snakes, which had been treated with the fluid more than a year previously, permitted of undulatory and spiral movements. Lungs thus prepared may, even after years, be inflated by means of bellows. Such old lungs were seen to swell to ten times their size in the collapsed state, the lobes became distinct, the brown color gradually changed into red, and the whole organ appeared as if taken from a fresh body. Sections of delicate tissues, morbid formations which have been removed by an operation, will appear after months as if in a fresh state, and may thus be preserved for future study.

All sorts of vegetable organisms may also be preserved in this fluid. A colony of exquisite fresh water algæ, which had been in the fluid for a year, appeared to be growing in the water.

The Prussian Government has purchased this valuable discovery, and the Minister of Instruction has published it in his official organ for the benefit of the scientific world. The formula for the preparation of the fluid is as follows: In 3,000 grammes of boiling water dissolve alum, 100 grammes; common salt, 25 grammes; saltpeter, 12 grammes; carbonate of potash, 60 grammes; arsenious acid, 10 grammes. After cooling and filtering, add to every ten liters of the solution four liters of glycerine and one liter of methylic alcohol.

The method of application differs according to the nature of the objects to be preserved. Anatomical preparations that are to be preserved dry are immersed in the fluid from six to twelve days, according to their size, then taken out and dried in the open air. Hollow organs, such as the lungs, etc., must be filled with the preserving fluid, then laid in a vessel containing the same liquid, and afterward distended with air and dried. Smaller animals, such as crabs, beetles, lizards, frogs, etc., if the natural colors are to be preserved unchanged, are not to be dried, but put immediately into the preparation. The same fluid may be used for the purpose of preserving human bodies during transportation, or even for more permanent embalming.

Milk a Forbidden Food in China.

The Chinese, who esteem rats to be a delicacy, are down on the use of milk. The following translation of a Chinese placard regarding the highly immoral practice of consuming cow's milk is sent to the *Foochow Herald* for publication: "Strictly refrain from eating cow's milk! Man should not rob the beasts of their food. Moreover of all beasts the cow is the most useful and meritorious. Men who do not discriminate between mankind and beasts are worse than senseless. Those who sell milk darken their consciences for gain, and those who eat cow's milk foolishly think they are benefiting their bodies. Men who take medicine should first carefully investigate and find out its nature. Why do not those who eat cow's milk consider and inquire into its origin? For instance, men beget children, and while the children are small they depend upon milk for their nourishment; so it is also with beasts. But when men buy milk to eat, do they not do injury to the life of the calf? And is there not bitter hatred and distress in the minds of both cow and calf? Beasts cannot speak; how then are they able to tell the man that, in eating the milk of beasts, his body becomes like that of birds and beasts? But if men wish to take strengthening medicine, there are numberless other articles in the world that are beneficial; and what necessity then is there for taking cow's milk? Besides this, the death and life of men have their fixed number and limit, and this cow's milk cannot lengthen out and continue the life of man. Since, then, all know the truth—that it cannot do this, all ought to act with loving and benevolent spirit. Especially all who receive this exhortation should keep from eating milk. The children of those who cause their families to refrain from eating milk will be preserved to grow up; they also will thus lengthen out their own lives, and will escape from evil in time of fatal epidemics. If such persons be able also to exhort others, who are ignorant of first principles, to leave off the eating of milk, their descendants shall surely prosper. Published by the Hall of Good Exhortations. The Xylographic blocks are deposited in the Ung Ling Köh."

It is said that the adhesiveness and durability of a solution of 100 parts gum arabic in 250 parts water may be increased by adding 2 parts of sulphate of alumina.

ANCIENT EGYPTIAN GLASSWARE.

On the tomb of Beni Hassan there are paintings representing Theban glass blowers working with blowpipes like those used at the present day. These paintings are supposed to date from the reign of Osortasen I., about 3000 B. C. At Thebes a necklace of glass beads was found bearing the name of the Queen of Thothmes III., who reigned about 1500 B. C. The Egyptians were skillful in the manipulation of glass, as many specimens preserved in the British Museum attest. Our engraving shows several specimens of this ancient ware; some of it is made of party-colored glass, while other specimens are plain.

Why the Sky appears Blue.

"Why is the sky blue?" is a question, says a recent number of the *Academy*, which has often been asked, but never satisfactorily answered. Helmholtz offered an explanation which depended on the reflection of solar light by the air particles in the atmosphere. These particles being very minute would reflect preferably the shortest waves of light, namely blue waves, while they would allow the longer waves, corresponding to green and red light, to pass through them; just as a log of wood floating on the surface of still water would throw off the tiny wavelets caused by a falling drop in its neighborhood, while the same log in long ocean swells would be tossed to and fro without noticeably impeding the progress of the waves.

Dr. E. L. Nichols (in the *Philosophical Magazine* for December) has propounded another view, which has much to recommend it. According to Young and Helmholtz's theory of color-impression there are in the eye three sets of nerve-termini, one set chiefly influenced by the red, another by the green, the third by the violet rays. The impression of color is the resultant of the intensities of these three effects. The impression upon these nerves is not directly proportional to the intensity of the ray, the different nerve-termini being subject to different laws. For very feeble rays the "violet" nerves are very sensitive, while the "green" and "red" nerves scarcely act at all. As the light increases in intensity the "red" and "green" nerves increase in activity, while the "violet" nerves become tired and dazzled. For rays of dazzling brilliancy the "red" nerves are in their most sensitive condition. Thus, of the simple colors, as the brightness increases, red and green change to yellow, blue becomes white. Daylight at ordinary intensities affects the three sets of nerve-termini equally; the resultant impression is whiteness. Now daylight is simply the light of the sun weakened by manifold diffuse reflections. The direct rays of the sun, as we let them fall upon any colorless object, appear also a white light; but on attempting at noon on a clear day to gaze into the sun's face the impression is of blinding yellow. It is not that the direct rays differ in composition from diffuse daylight, but that the "violet" nerves cannot transmit the action of such strong light. The moon, with enormously less illuminating power than the sun, seems bright, and is far brighter than the open sky. In passing from the intensity of the moon's rays to those reaching us from a corresponding bit of the open sky, we may, perhaps, take a step as great as that between the brightness of the sun and moon. In general, white light will appear bluer and bluer as its intensity diminishes, and this law will apply to the skies; as the light they reflect becomes fainter and fainter they will increase in blueness, even though the light by the process of reflection suffer no change in composition.

An Examination at the Institution for Deaf Mutes at Passy.

M. Houdin, the director of the institution, explained the method he has been putting in practice for thirty years, and which has for its object to teach mutes to speak and to instruct them by speech. He further stated that the constant testimony of facts, as well as the scientific data, show that all intelligent deaf mutes endowed with vision, the sense of touch, and an intact vocal organ, can speak, read speech on the lips of others, and can be taught by speech, and thus enter into communication with society. And he also remarked the superior position of the deaf mute who has been taught speech, to that of the mute who can only make signs which nobody understands.

A child, six years old, was presented for examination. He read fluently, with a clear voice, words which were written for him on the blackboard. He also named equally well all objects pointed out to him. He could also read from the lips all the words spoken to him, and wrote them on the board with a skill and rapidity quite extraordinary for a child of his age. He is able thus to read, articulate, and write all the words of the French language. He now uses, in ordinary phraseology, about 600 words, and, without doubt, will master the language and complete his education by this method of instruction.

Then followed an exhibition of pupils of three to four years of age, who read from the lips of others, spoke, and wrote from oral dictation. Madame Houdin dictated to them from a book, and they reproduced the text accurately without the least fault of orthography; and then they read aloud what they had written. Two of the pupils, young ladies, passed through the audience and answered intelligently and gracefully the questions put to them.

It was also noticed that in these children the expression of face was lively and happy, which is quite different from what is usually seen in the deaf who remain dumb. Their speech seemed natural, warm, expressive, and live, and not at all mechanical, cold, monotonous, and dead, as is often found in deaf mutes who have learned to talk.

M. Houdin explained that this success was due not only to particular care as to the manner of speaking in private and family life, but also to the precaution taken to make not only one organ speak after being put into mere automatic motion, but to make the intelligence speak through that organ, which alone can give warmth, color, and life to speech.

EGYPTIAN GLASSWARE (1500 B. C.)

There was then presented a young man, 16 years old, who had become totally deaf at 11 years of age, and who would have ended by losing his speech had his education been continued by signs, but in whom, on the contrary, speech had continued to improve even after considerable cessation of use, which had altered it greatly, and whose education finally could be completed by lip reading simply. His own statement was: "All I know is, that M. Houdin has taught me to read from the lips, and that I *see* the words instead of *hearing* them."—*La France Médicale.*

Court Plaster.

Soak isinglass in a little warm water for seventy-four hours; then evaporate nearly all the water by gentle heat; dissolve the residue in a little dilute alcohol, and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cold. Now stretch a piece of silk or sarsenet on a wooden frame, and fix it tight with tacks or pack thread. Melt the jelly, and apply it to the silk thinly and evenly with a badger hair brush. A second coating must be applied when the first has dried. When both are dry, apply over the whole surface two or three coatings of balsam of Peru. Plaster thus made is very pliable, and never breaks.

Petroleum in Colorado.

The Pueblo *Chieftain* says: A visit to the works of the Pioneer Oil Company, in South Pueblo, disclosed the fact that the company has its drill down something over 700 feet. The superintendent says that the drill is now over 1,200 feet below the coal measures, and every indication was as the most sanguine of the company expected. He thinks they will have to go 1,300 feet, or perhaps more, before they strike a flowing supply. The company has ample capital, and will go 2,000 feet, if necessary, to strike it. The formation gone through so far is almost identical with the formation of the Pennsylvania oil regions.

Introduction to a Biographical Sketch.

In the last issue of the *Journal of Science*, published in London, is a lengthy and interesting paper on the life and character of Hon. Henry Cavendish, F.R.S., an eccentric genius who lived in London from 1731 to 1810. Mr. Cavendish spent his life of eighty years in scientific investigations, leaving a record of his electric researches which were more complete than had been made by others at the time of his death. The writer, before introducing the subject of his biography, pertinently alludes to the advantages scientists of the present day have over those of the last century from the facility now had for promulgating discoveries and exchanging ideas through the public press.

If there is one Scriptural admonition, says the biographer, which the scientific workers of the present day fail to obey more rarely than another, it is the one which warns us against the foolishness of hiding our light under a bushel, instead of setting it on a hill so that it may shine before all men.

Every discoverer, nowadays, whether great or small, as soon as he finds his light—whether it be a six thousand-candle electric lamp or only a halfpenny dip—immediately hastens to place it on the top of the tallest hill he can find, so that it may shine forth literally *urbi et orbi*. Many lights, it is true, give forth only a feeble glimmer; but it is surely better that we should be at times overburdened with crude observations of possibly valueless facts, than that a single particle of truth should be concealed, or its publication delayed even for a day more than is absolutely necessary.

There never was a period in the world's history when scientific observation was so universal as in the present year of grace, and it never before had such a chance of being so thoroughly controlled by publication and criticism. An important discovery in any branch of physical science is now made public with a rapidity that has never before been equaled, and the paper, article, or even telegram containing its history is published and republished, discussed, and criticised in every civilized language. The observations described are repeated and tested in half a hundred laboratories, and the slightest incorrectness or misstatement is pounced upon with the utmost eagerness, and published with the same universality as the original researches themselves. The numerous facilities which we possess for spreading and sifting scientific observations are bearing fruit every day, and the scientific press—although its office is to collect and distribute facts rather than to criticise them—has become as great a power in its own particular sphere as its elder sister, the political press, has in the hands of our political fellow workers.

A Wonderful Surgical Operation.

The *Evening Post*, one of the most reliable of our city dailies, gives the following account of a very remarkable operation now proceeding at Bellevue Hospital. The patient is a young man, twenty-one years old, who lost his nose through what is known as a lupoid ulcer, the result of a blow from a club, and the operation will result in the replacement of that useful organ, or rather the substitution of a part of one of the sufferer's fingers for the missing feature. The first step, which was taken some weeks ago, was to remove the nail from the middle finger of the patient's left hand. Two deep incisions were then made at the base of the nose, and pieces of flesh were brought down to cover the opening caused by the destruction of the nasal bones and cartilages. Next incisions were made at the upper extremity of the nose to form a pocket for the reception of the end of the finger to be transplanted. The next step was to open the finger from the second joint to the tip and to place the finger in position on the patient's face, securing the flaps by silver sutures. This was done five weeks ago, and the surfaces have united admirably. The next operation will be the amputation of the finger at the first joint, when the bones of the transplanted phalanges will serve admirably to replace the nasal bones. A triangular flap of skin will then be brought down from the forehead to form a uniform surface for the new nose, and the job will be completed. It may be added that at one point of the operation the patient's breathing was so obstructed by blood running down his throat that it became necessary to insert a silver tube in his windpipe.

During the last few weeks the patient has been kept under the influence of anæsthetics, and his arm and head have been kept in position by means of plaster of Paris. The operation was suggested by a similar experiment in Birmingham, England; but it is so much more complicated in its nature that it is practically original.

REMEDY FOR CORNS.—Mr. Gezow, a Russian apothecary, recommends the following as a "sure" remedy for corns, stating that it proves effective within a short time, and without causing any pain: Salicylic acid, 30 parts; extract of cannabis indica, 5 parts; collodion, 240 parts. To be applied by means of a camel's hair pencil.—*Pharm. Zeit.*

Railroad Construction in 1879.

The total of the year was 4,430 miles, which is the largest since 1872, and has been exceeded only four times in the history of the country—the four years ending with 1872. For the eight years that we have made up this record, which includes road on which *track was laid* during the year, whether opened for traffic or not, and differs materially from the figures in *Poor's Manual* (which usually include only road open for business), the miles of new road constructed have been:

Year.	Miles.	Year.	Miles.
1872	7,340	1876	2,460
1873	3,883	1877	2,281
1874	2,025	1878	2,916
1875	1,561	1879	4,430

Compared with 1878, therefore, last year shows an increase of more than 50 per cent. At the close of 1878, according to *Poor's Manual*, the length of railroad in the country was 81,841 miles. Adding the mileage constructed in 1879, we have the grand total of 86,263 miles of railroad in the United States at the beginning of the current year, when the total of all Europe is about 100,000 miles, and of all the rest of the world probably not 20,000 miles. The increase in this country was at the rate of about 5½ per cent, the increase of population being doubtless something less than 3 per cent so that the number of inhabitants per mile of railroad has become less during the year. The population of the country is now probably about 49,500,000, and this gives 574 persons to support 1 mile of railroad, against 585 at the beginning of 1879. In Europe the average is about 3,333 per mile of road, and in Sweden, where the mileage in proportion to population is largest, it is 1,667. We have given these figures before, but we repeat them to emphasize the fact that this is peculiarly the railroad country, not simply because it is big, but because the same population requires a larger amount of railroad here than anywhere else.

Of the 4,430 miles, 923¼ miles are of narrow gauge (18 miles 2 feet, 23 miles 3½ feet, and the rest 3 feet gauge). This is a little less than 21 per cent of the whole, against about 30 per cent in 1878.—*Railroad Gazette.*

Recent Explorations in Afghanistan.

For a period of about 40 years it has been known that interesting Buddhist remains existed in the Jellalabad Valley, although little or no attention has been given to their investigation. Mr. William Simpson, having been quartered for some months in the valley, with the force under General Sir Samuel Browne, has been able to visit most of the remains in that region and to make sketches of them, and the results of his investigations are given by him in a paper published in a recent number of the *Journal of the Society of Arts.* These Buddhist remains, says Mr. Simpson, are little more than mounds. Here and there the crumbling remains of a stupa may be seen, and fragments of walls can be traced in the heaps. The immense quantity of these mounds is astonishing; and, as it is known that these Buddhist establishments were monasteries, the extent of the remains seems to indicate in the past a population of ascetics alone far greater than the population of the present day. In the Buddhist period, the country must have been under a high state of civilization, where wealth abounded and art was cultivated. The vestiges of art still remaining show that the religious structures of the time were large and important. A style of architecture was followed in which sculpture was largely practiced, and in which the effect was heightened by the use of color and gold. The structures connected with the practice of the Buddhist faith were "viharas," or monasteries, places in which each monk had his cell, and with buildings for worship. One prominent form of the ritual was connected with structures which are now known as "topes" or stupas. "Dagoba" and "chaitya" are also terms used to designate the same kind of structure

The Afghanistan tope, unlike those of Sanchi, Bharut, and Amaravati, have a square base It is ornamented with a cornice and pilaster; large and imposing stairs are made to ascend to the platform formed by it above, on which the circular part of the tope stood. Among the topes in the Jellalabad Valley which are not quite reduced to the condition of mounds, the Greek influence is very distinctly marked in the architecture. The capitals are all Corinthian; and the more ornamental structures have a series of Corinthian pilasters, with base mouldings and friezes

Regarding the monasteries little can be said, for scarce a vestige of them now remains. All throughout Afghanistan there is an immense number of caves. At Bamian, about a hundred miles north of Cabul, there is what may be called a city of caverns. At Hada, and at almost all the groups of topes, there are numerous caves associated with them. Nearly all of these, as a rule, are about the same size. They are merely arched recesses in the rock, about 12 feet high, of the same width, and about 20 feet long. That they were decorated with color is shown by the traces still visible in the decorations in a small group at Hada. Enough is left also to distinguish panels, in rows, with heads of Buddha or Buddhist saints with the nimbus. At Darunta there is a very large and remarkable group of caves. The rock above had monasteries and topes of an extensive character upon it. The most interesting of these caves are in a perpendicular cliff overhanging the Cabul river.

Mr. Simpson concludes his paper with a short account of the excavations made by him at the Ahin Posh tope, near Jellalabad. Of this structure nothing is left but the lower part of the square base; and there is only a small portion remaining of the first course of masonry of the circular part of the tope, and which is 80 feet in diameter. The base is 100 feet square, and is ornamented with Corinthian pilasters. There had been an inclosure all round the tope, forming a courtyard about 500 feet square. Through this the principal gateway entered from the south, in a line with the original stairs on the south and north side of the tope. This approach was evidently an important construction. There was further evidence of what it had been in the remains of colossal figures, which were brought to light. The size of these may be judged of by the size of the feet, which were 23 inches long, and which were all that remained of the statue to which they belonged. On digging a tunnel into the center of the tope, the external wall was found to be composed of stones and slates, so arranged as to produce a diaper or checkered pattern—a style of masonry peculiar to all the remains of the Buddhist period. In his excavations, Mr. Simpson was fortunate enough to come upon the cell, which was formed of layers of slate, and was a perfect cube of 16 inches. In this small repository, which constituted the sanctum, in honor of which the monument had been raised and to which the ritualistic ceremonies of the Buddhists were directed, there were found two handfuls of dark looking dust, which were probably part of the ashes of some noted holy man of the time, deposited after cremation—the rule of the Buddhist priesthood. On top of the ashes lay a golden relic holder, octagonal in form, about 4 inches long, and set on each of its faces with stones. Among the ashes were 20 gold coins, 17 of them Bactrian or Indo-Scythian and 3 Roman. These coins, which were in splendid condition, and the relic holder, were no doubt deposited as offerings along with the ashes at the consecration ceremony of the shrine. The coins are only a negative evidence toward the date of the tope; but from them it is certain that the latter is not older than the second century. How much later it may be is rather a difficult question as yet to determine. The Roman coins seem to show that Afghanistan was the way of commerce from Central Asia into India in remote times.

The Viscosimeter.

This is the name given to an instrument by means of which the viscosity of a sample of beer can be determined. It consists in its simplest form of a funnel-shaped vessel, the lower extremity of which is drawn out to a fine point, so that the internal diameter is as fine as a capillary tube. A certain quantity of distilled water being placed in the funnel-shaped reservoir, a determination is made of the quantity which will run through in a given time, say five minutes; for example, we will assume this to be 21 cubic centimeters; the same quantity of the beer to be tested is then placed in the instrument, and an observation made of the quantity running through in the same time, we will suppose this to have been 15 cubic centimeters. The viscosity is in inverse proportion to the quantity of fluid flowing through the tube in a given time; taking the viscosity of water at 1,000, we have the following proportion:

$$15 : 21 :: 1000 : V,$$

$$\therefore \quad V = 1400.$$

Many precautions have, of course, to be taken; all determinations must be made at the same temperature, and, if possible, at the same barometric pressure; any excess of carbonic acid gas should be previously removed from the beer, by shaking a portion of it in a bottle until no more gas is given off; if the beer is at all thick it must be filtered, otherwise some of the suspended particles may mechanically close up the capillary tube. The determination of the viscosity of beer is of value for many purposes, for any great excess is an unfavorable sign. Any tendency toward "ropiness" can be detected by this instrument. It would also probably be of considerable value to the practical brewer for testing his worts, with the view of determining the dextrine ratio. A dextrinous wort will run through much slower than a saccharine wort, and we think some very useful results might be obtained by the aid of this instrument. Its construction is very simple, and any one with but a slight experience in chemical manipulation may make one for himself.

Speaking Dictionary.

M. Lambrigot has invented a modification of Edison's phonographic matrices, by substituting stearine for the tin foil, and electrotyping the impressed surface. It has been suggested that these electrotypes, which can be made very cheaply, may render great service in the study of foreign languages, for they preserve indefinitely and repeat as often as may be desired words that are the most difficult to pronounce correctly. A true speaking dictionary might thus be made, an undertaking which the wildest fancy would not have dreamed of a few years ago.—*Nature.*

The Brussels Exhibition.

In a letter to the Secretary of State, Mr. Goodloe, Minister at Brussels, calls attention to the Industrial, Agricultural, and Horticultural Exhibition to be held in Brussels this year, from June 15 to October 15. No foreign exhibitors will be invited or allowed to participate, but there will be an excellent opportunity for foreigners to critically inspect Belgian products, and it is suggested that enterprising Americans who have some of their wares on hand can show them to a great assembly gathered from every section of Europe. They will not be allowed to show goods in the Exhibition Building, for the Exhibition will be strictly a national one—a feature of the celebration of the fiftieth anniversary of the existence of Belgium as an independent nation.

AGRICULTURAL INVENTIONS.

Mr. Benjamin Middleton, of Muscatine, Iowa, has patented a device for heating hot-beds, green-houses, and the like. It consists in means for forcing heat and moisture to plants through an unvarying surface of porous bricks, tiles, or other equivalent substances.

Mr. Alexander B. Campbell, of Albion, Wis., has patented an improved harrow coupling, which forms a flexible connection between the several harrow bars. It consists in a harrow coupling formed of a clevis attached to a harrow bar, the upper shank of which clevis is lengthened and terminates in an eye, into which a bar hook attached to the forward part of the clevis of the following harrow bar passes.

Mr. William Pendley, of Ludville, Ga., has patented an improved machine for planting seed, distributing guano, cultivating cotton and other plants, and for other plowing. It is so constructed that it may be readily adjusted for these various uses.

The Crops of 1879.

The Agricultural Department has published a comparative table on the crops produced in 1878 and 1879, together with the prices obtained by the producers, as follows:

HARVEST.	1878.	1879
Wheat, bushels	420,122,400	448,755,000
Corn, bushels	1,388,218,750	1,544,899,000
Oats, bushels	413,578,560	364,253,600
Rye, bushels	25,842,790	23,646,500
Barley, bushels	42,245,630	40,184,200
Buckwheat, bushels	12,246,820	13,145,650
Cotton, bales	5,216,603	5,020,387
Tobacco, pounds	392,546,700	384,059,659
Hay, tons	39,608,296	35,648,000
Potatoes, bushels	124,126,650	181,360,000
PRICE.		
Wheat	$326,346,424	$499,008,000
Corn	441,153,405	580,250,000
Oats	101,945,830	120,855,000
Rye	13,592,826	15,510,000
Barley	24,483,315	23,635,000
Buckwheat	6,454,120	7,856,185
Cotton	193,854,641	231,000,000
Tobacco	22,137,428	21,434,391
Hay	285,543,752	325,851,280
Potatoes	73,059,125	78,971,000
Total	$1,489,370,000	$1,904,480,[illegible]

This increase of some $415,000,000 in a single year is a most encouraging result. But there has also been a gain in other values besides those of the crops noted above. The statistician of the department, who is reported to be gathering material upon which to base a careful estimate of the total increase in certain other values during the year just closed, to include the increased price of real estate and mining property, expresses the opinion, based upon material already gathered, that it will not fall below $1,000,000,000.

Progress of Long Range Telephoning.

An important experiment with the telephone was made, January 25, between the Union Pacific Transfer on the east side of the Missouri River and the American Union office at St. Louis, a distance of 410 miles. The experiment previously made between Omaha and St. Louis had been unsatisfactory. Superintendent Dickey, of the telegraph lines, and also head of the Bell telephone system in the West; Manager Korty, of the Union Pacific Telegraph office, and Manager France, of the Omaha Telephone Exchange, conducted the experiment at this end of the wire, and Mr. Benedict, of the American Union, and Mr. Durant, of the St. Louis Telephone Exchange, conducted the experiment for St. Louis. Two jars, Calland battery, were used at the Omaha end and five jars in St. Louis. But two or three interruptions of a few seconds each occurred, and these were clearly due to the "swinging" of the wires in the strong wind which was blowing.

An ordinary conversation was carried on with the utmost ease, the most noticeable fact being that, while the enunciation of the words was perfectly clear, they came invariably with the regular vibration of a musical note. The wires over the greater part of the distance were quiet and not in use, but at the St. Louis end there was a heavy induction.

Mr. W. H Preece, in a recent lecture in London on sound, speaking of long distance talking by aid of the telephone, said that Prof. Bell and himself had carried on conversation through an instrument having a resistance that represented 10,000 miles of wire; in fact it was really a telegraph 10,000 miles long. He said there was no doubt whatever that if, like Jules Verne's hero, we could go to the moon and string a wire along that distance, there would not be the slightest difficulty in maintaining telephonic communication with the earth.

Aluminum Telegraph Wires.

German telegraphic engineers have lately been experimenting with aluminum as a material for telegraph wires. This metal can easily be drawn out to a very much finer gauge than is possible with iron, and its conductibility is twice as great as that of iron wire. Its excessive cost has hitherto prevented its use for the purpose indicated, but it is found that an alloy of aluminum and iron can easily be made, which will produce a wire both finer and stronger, and less susceptible to atmospheric changes than iron wire, while it is much superior as a conducting medium.

ATTENTION is called to the advertisement in another column of valuable manufacturing sites for sale and to let by the Dundee Water Power and Land Company, of Passaic, N. J. The water power is said to be ample and permanent The place is at the head of navigation on the Passaic river, this, together with its proximity to Paterson, Newark, and New York city, renders it particularly desirable.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Chase's Pipe Cutting & Threading Machine. Send for circular. Chase Machine Co., 120 Front St., New York.

Best Turkey Emery in bbls., kegs, and cases. Special rates for large quantities. Greene, Tweed & Co., N. Y.

J. F. Tallant, Engineer, Burlington, Iowa, makes a specialty of saving fuel and increasing power of defective boilers and engines.

The steam pipes, boilers, etc., of Messrs. Dunham, Buckley & Co., A. T. Stewart & Co., and S. Shethar & Co., are protected with H. W. Johns' Asbestos Boiler Coverings. H. W. Johns Manufacturing Company, No. 87 Maiden Lane, New York, sole manufacturers of genuine Asbestos Liquid Paints, Roofing, etc.

Blake's Belt Studs. The most durable fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

Ice Machines selected. Information on all kinds. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Hydraulic Jacks and Presses. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

The best article (because it is common sense) we have read on the subject of high and advancing prices, appears in the editorial department of *Baldwin's Monthly*, just published for February. We say to every one of our readers, get a copy and read it. Baldwin the Clothier is the sole editor.

For Sale at a great sacrifice if sold soon. Half interest in Machine and Repair Shop. Inquire of "Machinist," Box 32, Farmington, Iowa.

Wanted—A Drill Press, a Bolt Forging and Heading Machine, and a Pulley Lathe, of some new and improved pattern. Good second-hand machines might answer. Address Columbus Iron Works Company, Columbus, Ga.

Wanted.—English Iron Farm Gates. Howard, Pikesville, Md.

M'f'rs of Physical, Optical, and Electrical Apparatus, also makers of small machinery and tools, send catalogues and price lists to G. M. H., Box 773, N. Y. city.

A Rare Chance.—We have on hand a 40 H. P. Horizontal Oscillating Engine, built for special work, but never used. It is first-class in all respects; has patent guides to prevent wear; has balance wheel, but no pulley. Price $800. Bond, Sisco & Co., Baldwinsville, N. Y.

New Inventions examined and tested. Designs and improvements. Reports for investors. Recipes and information on all industrial processes. Benjamin's Sci. Expert Office, 37 Park Row, New York.

For Sale.—One Wood Turning Lathe, 20" swing, 14 ft. bed. Jig Saw and Face Lathe for pattern work; also Blacksmiths' Tools. D. Frisbie & Co., New Haven, Conn.

Campbell's Self-acting Window Shade Rollers are the best in the market. Models and terms to the trade. 95 Centre St., New York.

Wanted.—A Machinist of experience, competent to superintend a large manufactory. Address, with references in full, F. Case, Box 782, Cincinnati, O.

Small High Speed Steam Yachts complete or in parts. Geo. F. Shedd, Waltham, Mass.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave., Phila.

Partner Wanted.—See advertisement on inside page.

Models made to order. H. B. Morris, Ithaca, N. Y.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 61.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars send for pamphlet.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., etc., sent post free on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 77.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 61.

For Machine Knives and Parallel Vises, see advertisement, p. 61. Taylor, Stiles & Co., Riegelsville, N. J.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Forges, for Hand or Power, for all kinds of work. Address Keystone Portable Forge Co., Phila., Pa.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eclipse Portable Engine. See illustrated adv., p. 94.

Repairs to Corliss Engines a specialty. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 62.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Eagle Anvils, 9 cents per pound. Fully warranted.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$275 Horizontal Engine, 20 H. P. See page 190.

Emery Wheels of all kinds, and Machines at reduced prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 93.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

For best low price Planer and Matcher and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 93.

The Twiss Automatic Cut-off, also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN CHEMICAL JOURNAL.

The fifth number contains articles on the following subjects: On the Synthesis of Helicin and Phenol-Glucoside, by Arthur Michael; On a New Formation of Stilbene and some of its Derivatives, by Arthur Michael; On a New Method for the Separation and Subsequent Treatment of Precipitates in Chemical Analysis, by F. A. Gooch; On several Spanish Minerals, by F. A. Genth, Jr.; A Method for Estimating Bismuth Volumetrically, by M. Kuhara; New Results in Electrolysis, by Edgar F. Smith; Nitrosulphobenzoic Acids and some Derivatives, by Edward Hart. Professor Mallet continues his Brief Review of the most important Changes in the Industrial Applications of Chemistry within the last few Years, and a Report on Progress in Analytical Chemistry is continued by H. N. Morse. A variety of useful notes complete the number.

EXPERIMENTS ON THE STRENGTH OF WROUGHT IRON AND OF CHAIN CABLES. By Commander L. A. Beardslee, U. S. N. Revised and abridged by William Kent, M.E. New York: John Wiley & Son. 8vo, pp. 119.

An abridgment of Commander Beardslee's voluminous and valuable report published by the United States Government last year.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) T. asks: How many cells of Callaud battery will be required to do light silver plating? A. If you use a striking bath you will need eight or ten cells. Brass, copper, and German silver articles may be silvered with a single cell.

(2) C. E. H. asks: 1. Do you know of anything that may be added to the gelatine and glycerine, that forms the copying pad described in the SCIENTIFIC AMERICAN, that will make it more tenacious and not injure its copying properties, as with the ingredients given parts of the pad sometimes adhere to the paper used in copying? A. Heat the composition for several hours over a water bath to expel as much of the water (used in softening the glue) as possible. Then let stand several hours in a cool place to harden. If required to be used in a hot room, add more glue and, say 5 per cent. of alum to the composition. 2. Are there other preparations used for this purpose? A. There are several similar compositions in use.

(3) P. G. R. asks: If a solution be made with pure gold, nitric and muriatic acids, can the acids be drawn off leaving the gold in a powdered state; if so, how? A. Evaporate the solution, nearly to dryness in a porcelain lined iron vessel over the waterbath, to expel excess of acids; redissolve the residue in warm water, mix with 10 per cent of oxalic acid, and let stand over night. Or add to the aqueous solution 20 per cent of pure copperas (sulphate of iron) dissolved in a small quantity of warm water. Let the precipitated gold, which in the latter case is of a dull brownish color, settle, carefully decant the solution, and heat the powder to low redness.

(4) J. W. C. asks: 1. Is bay rum injurious when applied, without reducing, to the hair? A. In moderation, no. 2. Can you tell me why the bay rum which I diluted a short time ago with warm water, immediately assumed a milky white appearance and so remained, utterly devoid of the usual odor given out by good bay rum? A. It is due chiefly to the insolubility in water of the essential oils contained in the spirit. Use dilute spirit instead of water.

(5) T. S. B. asks: What is the best cement that can be used to cement a glass tube into a mercury reservoir made of iron for a pressure column at 60 pressure (and less)? In the one we have put up the mercury oozes through the pores of the plaster of Paris with which we have made the joint to connect the glass tube with the bell end of iron reservoir. A. Better adapt the surfaces by grinding; use a rubber washer and small screw clamp collar, resting on a shoulder blown in the glass. For ordinary purposes a good rubber stopper, closely perforated to admit the tube, will answer very well. Cements cannot be depended on in this connection.

(6) F. T. asks how the coppersmiths retin their old copper saucepans and have them look so bright inside. We do a considerable of this kind of work, but are unable to give them a bright color inside. A. Thoroughly cleanse by means of dilute sulphuric acid, or hydrochloric acid nearly saturated with zinc (acid zinc chloride), and moist pumice powder; if necessary, rinse. Warm the pan, pour in a small quantity of grain tin, melted in a ladle, and a little rosin powder; quickly brush this about with a brush made of a bunch of hemp, so as to bring the fused metal in contact with every part of the surface to be tinned. The pot or pan must be kept hot enough to prevent the tin from solidifying. As soon as the parts are properly coated, pour out the excess of melted metal, invert, and remove the selvage by means of the brush.

(7) A. W. H. writes: I have made a copying pad as per instructions in No. 21, Vol. xli., and it worked splendid first time, having taken one hundred and two good, legible impressions from one copy. Please say if an ink can be made to be used on stereotype plates and wood cuts (and not injure them) to be transferred to paper and from there to the pad, same as the ink you give directions for in above number. A. We have not experimented in this direction. Probably such an ink could be made. Have you tried a clear, saturated aqueous solution of 3B methylviolet with and without glycerine?

(8) M. H. G. asks: 1. In the plan of the "Sharpie" in the SUPPLEMENT, what is the distance on the bottom inside from deadwood to forward end of centerboard? A. The distance, 13½ feet, is given by the builder. 2. What are the dimensions of the keelson? A. The same thickness as the keel and somewhat deeper. 3. How should it be fastened to the bottom? A. Fasten through and through with rivets. 4. Am I to understand that three inches is the width of centerboard? I should not think it wide enough. I never saw one so narrow. A. 3 inches is correct.

(9) G. & B. ask: What will protect iron from sulphuric acid? Will liquid glass answer, if applied often? A. No; try a thick coating of genuine asphaltum varnish. Let it harden thoroughly before using.

(10) C. W. H. asks (1) whether in testing with tannic acid for impurity in water, the presence of the bicarbonates of sodium or calcium would affect the analysis, and if so how. A. Heat the water, cool and filter before adding the tannin, if the water contains any considerable quantity of free carbonic acid or bicarbonates. 2. How can I test mineral spring water to detect impurities if they exist? A. Consult Wanklyn and Chapman's "Water Analysis." See also back numbers of the SCIENTIFIC AMERICAN on this subject.

(11) A. E. K. writes: I have made copying pad and ink according to directions, and work all right, but the ink does not start freely from the pen. A. Let settle, decant, and add a little alcohol.

(12) C. E. B. asks: 1. What chemical process can be used to keep water very cold? I have an air-tight vessel that contains six gallons of water, and desire to keep it cold. A. See "Ice, Artificial," Johnson's or Appleton's Encyclopedias, Knight's "New Mechanical Dictionary," and the back numbers of the SCIENTIFIC AMERICAN SUPPLEMENT. 2. How long will it remain cold? A. It will depend upon the shape, size, material, surroundings, etc., of the vessel. Consult Tyndall's "Heat as a Mode of Motion."

(13) G. W. G. asks: What would be the dimensions of a cylinder capable of driving a ten horse power engine? A. It depends upon the speed at which the engines are run; ordinarily about 8 inches cylinder by 12 inches stroke.

(14) F. T. S. writes: 1. I have two glass jars, 4x7, and a zinc. Could I make a battery with zinc in one jar and copper in the other? A. No; the zinc and copper must be in the same jar. They may be separated by a porous cell, as in the Daniell, or they may be placed one over the other in the zinc above the copper, as in the gravity. See SUPPLEMENTS, 157, 158, and 159, on the construction and operation of batteries. 2. What weight copper will I need with reference to weight of zinc? A. The weight is immaterial, but the surface should be as great as that of the zinc, and it is generally made greater. 3. What solution? A. Saturated solution of copper sulphate. 4. Will it move a sounder? A. Yes. 5. About how many feet of wire are there on sounder and relay magnets? A. Make the thickness of the wrapping equal to the diameter of the magnet core. The resistance of the relay should correspond with certain conditions of line battery, etc. 6. Will a sounder intended for short line work on a long line by winding more wire on the magnets? A. Within certain limits, but it is not a good idea. Better rewind the magnets with finer wire. 7. What is a relay used for? A. It is placed in a line for controlling a local circuit.

(15) A. P. B. asks: 1. What is the composition of the rubber used in making rubber hand stamps? A. Purified caoutchouc containing about 6 per cent of sulphur. 2. How is it melted before pouring into the mould? How is it prevented from adhering to the plaster, after cooling? A. It is not melted. See "How to Make Rubber Stamps," p. 1326, No. 83, SCIENTIFIC AMERICAN SUPPLEMENT. Also articles on vulcanizing rubber, pp. 48 and 165, Vol. 39, SCIENTIFIC AMERICAN.

(16) S. C. asks if there is a United States standard weight for a gallon of milk, and how much it is. All the milk here is sold by wine measure, 231 cubic inches to the gallon. I don't think it is right. I think in New York the milk is sold by beer measure, 282 cubic inches to the gallon. Am I right? A. 231 cubic inches is the standard gallon.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

H. W. V.—1. Hornblende, quartz, orthoclase, and calcite. 2. Graphite and hornblende. 3. Clay slate. 4. Syenite. 5. Siliceous hematite. 6. Graphite in greenstone. 7. Marcasite. 8. Hematite. 9. Chiefly quartz rock. 10. Syenite with limonite.—Sample marked "geological specimens," an excellent variety of limonite, an ore of iron.—F. W. O.—The metal is antimony, probably worth 10 cents per pound in large quantities.—J. B. B.—It is jasper or chalcedony.

COMMUNICATIONS RECEIVED.

On Fly Wheels. By C. T. S.
On Railroad Crossings. By J. T.
On Temperature of the Sun. By D. F. S.
On a Theory of Cold and Mild Winters. By G. R. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 13, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Accordion, F. Zogbaum ... 223,461
Acid, manufacture of anhydrous sulphuric, J. A. W. Wolters ... 223,521
Aging liquors, apparatus for, J. C. Vetter ... 223,534
Axle box, vehicle, A. J. Robinson ... [illegible]
Bale tie buckle, J. M. Thayer ... 223,536
Ball trap, I. A. Paine (r) ... 9,042
Belt fastener, J. McGeorge ... [illegible]
Berth guard for sleeping cars, E. A. McMann ... [illegible]
Berth protector for sleeping cars, G. W. Farlee ... [illegible]
Bit brace, A. H. Crockford ... [illegible]
Bleaching solution of soda or potassa, preparing an aqueous, P. J. Austen ... [illegible]
Boiler furnace, steam, G. F. Pike ... [illegible]
Book holder, J. L. Highbarger ... [illegible]
Boots and shoes, manufacture of, L. R. Blake (r) ... 9,043
Bottle stopper, S. S. Newton ... [illegible]
Bottle stopper and fastener, R. McCully ... [illegible]
Bread pan, A. W. Williams ... [illegible]
Brick machine, pressed, Z. Vanier ... 223,617
Brick, pottery, etc., kiln for burning, H. Eschenbach ... [illegible]
Bucket, tub, etc., wooden, T. Richards, Jr. ... 223,541
Buckle trace, J. Lally ... 223,444
Butter package, J. Carpenter ... [illegible]
Cane juice, appar. for bleaching, J. M. Leeuwin (r) ... 9,045
Car coupling, F. E. Hickox ... [illegible]
Car frame, G. W. Cushing ... 223,497
Car wheel guard, railway, S. Brisco ... [illegible]
Cars, propelling, O. H. Jadwin ... [illegible]
Carbureter, H. C. De Witt ... [illegible], [illegible]
Cardboard, machine for cutting and scoring, C. Brombacher ... [illegible]
Carriage, extension, H. C. Seely ... [illegible]
Chart, dressmaker's, M. E. Riley ... [illegible]
Churn, S. P. Mecay ... [illegible]
Churn, H. A. Rabcock ... [illegible]
Clock, electric time registering, J. B. Johnson ... 223,317
Clock, time registering, E. Prescott ... [illegible]
Cloth cutting knife, N. Rubenstein ... 223,544
Clothes pounder, Hewitt & Bennett ... [illegible]
Coal culm for fuel, etc., preparing, C. Detrick ... [illegible]
Cock, stop, C. H. Cushing ... [illegible]
Cocks, machinery for grinding, J. L. Hayden ... [illegible]
Commode, portable, W. S. G. Baker ... [illegible]
Cot, R. Stilwell ... [illegible]
Cotton chopper and cultivator, C. C. & A. G. Davis ... [illegible]
Cotton picking shade, J. C. Bonthat ... [illegible]
Counter stiffeners, machine for shaping, L. Cote ... [illegible]
Curtain roller, J. C. Lake ... [illegible]
Damper regulator, automatic, F. A. Jones ... [illegible]
Door bolt and check, combined, I. D. Bush ... [illegible]
Door wicket, Stroud & Tilton ... [illegible]
Dress protector, E. S. Williams ... [illegible]
Drier, Leidersdorf & Mandel ... [illegible]
Drum, A. L. Foraut ... [illegible]
Easel for carriage painters, D. Warrington ... [illegible]
Electric lighting, D. Flanery ... [illegible]
Electric lighting apparatus, A. J. Martin ... [illegible]
Electric machine, dynamo, Thomson & Houston ... [illegible]
Elevator safety attachment, F. J. Schmitt ... [illegible]
End board for wagon boxes, F. B. Graff ... 223,443
Eyebolts, machine for making, Briggs & Dougherty ... [illegible]
Farm gate, D. C. Kinsell ... [illegible]

DESIGNS.

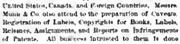
TRADE MARKS.

English Patents Issued to Americans.

From January 2 to January 13, inclusive.

Axles for vehicles, E. A. Wible, Folsom, Cal.
Buttons, attachment of, P. Chase, Pawtucket, R. I.
Churn, J. B. Williams et al., Bellows Falls, Vt.
Cutting meat, machine for, Libby, McNeill & Libby, Chicago, Ill.
Electric light apparatus, T. A. Edison, Menlo Park, N. J.
Engine governors, G. F. Pottle, Boston, Mass.
Fire alarm and extinguisher, H. H. Rogers, N. Y. city.
Firearm, W. Trabue, Louisville, Ky.
Gas, manufacture of, H. C. Hall, Brooklyn, N. Y.
Gutta percha, manuf. of, H. Gerner, New York city.
Horseshoe nail machinery, L. W. Whipple, Boston, Mass.
Iron, treatment of, E. Wheeler, Philadelphia, Pa.
Lubricator, C. Parshall, Detroit, Mich.
Lubricating machinery, C. Parshall, Detroit, Mich.
Motive power from oil, C. Holland, Chicago, Ill.
Musical instruments, M. J. Mathews, Boston, Mass.
Oil, treatment of, D. D. Cattanach, Providence, R. I.
Piston rod packing, T. Tripp, Stoughton, Mass.
Railway signal, J. S. Williams, Riverton, N. J.
Rolling mills, W. H. Glover et al., St. Louis, Mo.
Screw cutting machinery, D. Morrell, Hartford, Conn.
Spinning machine, A. F. Crichton, New York city.
Steam boilers, G. H. Pond et al., New York city.
Steel, manufacture of, H. C. Bull, Brooklyn, N. Y.
Sleeping berths for ships, D. Parks, Boston, Mass.
Telephonic exchange apparatus, Law Telegraph Company, New York city.
Telephone switches, E. T. Greenfield et al., B'klyn, N. Y.
Telephones, T. A. Edison, Menlo Park, N. J.
Telephonic apparatus, E. Berliner, Boston, Mass.
Valve for barrel taps, G. W. Gillette, New York city.

Advertisements.



CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 30,000 copies every weekly issue.

WOOD SOLE SHOES. The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send for circular to
CHAS. W. COPELAND, 122 Summer St., Boston, Mass.

STEAM PUMPS.

FIRE PUMPS,
TANK PUMPS,
MINING PUMPS,
OIL LINE PUMPS,
BREWERY PUMPS,
AIR COMPRESSORS,
SALT WATER PUMPS,
SUGAR HOUSE PUMPS,
BOILER FEED PUMPS,
THREE CYLINDER PUMPS,
BALANCE WHEEL PUMPS,
COMBINATION PUMPS,
HYDRAULIC PUMPS,
GAS COMPRESSORS,
REFINERY PUMPS,
MARINE PUMPS,
POWER PUMPS,
HOTEL PUMPS,
ACID PUMPS,
AIR PUMPS,

THE NORWALK IRON WORKS CO., SOUTH NORWALK CONN.

COLUMBIA BICYCLE. A practical road machine, indorsed by the medical profession as the most healthful of outdoor sports. It far exceeds three-fold the locomotive power of any ordinary man. Send 3c. stamp for 24 page catalogue, with price list and full information.
THE POPE M'F'G CO., 89 Summer Street, Boston, Mass.

TRY
THE LEHIGH EMERY WHEEL.

For catalogue and prices, address
LEHIGH VALLEY EMERY WHEEL CO., WEISPORT, PENNA.

SHEPARD'S CELEBRATED $60 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO., 331, 333, 335, & 337 West Front Street, Cincinnati, Ohio.

MICROSCOPES and every description of Optical Instruments, the best and the cheapest. Send for Illustrated Priced Catalogues.
R. & J. BECK, Manufacturing Opticians, Philadelphia, Pa.

H.W.JOHNS' ASBESTOS

ASBESTOS STEAM PACKING, In all sizes of rope.

ASBESTOS FELT PACKING, In sheets and gaskets, all sizes.

ASBESTOS WICK PACKING, For small valve stems, etc.

Are ten times as durable as any others, and are indestructible by fire or acids.

ASBESTOS CEMENT FELTING and AIR CHAMBER COVERINGS, for steam pipes, boilers, etc., are the most effective, durable, and economical non-conductors in the world. They can be readily applied by any one.
Send for descriptive price lists.

H. W. JOHNS MFG. CO., Sole Manufacturers of Genuine Asbestos Materials, 87 MAIDEN LANE, NEW YORK.

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought STRUCTURAL IRON. It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished on application.

"Why don't you run your Files by Steam Power?"

You might as well mount a Circular saw on a Grindstone frame, and turn it with a crank or treadle, as use a File by hand. The File is a costly tool at the best. Its cutting points are all on the surface, and each stroke lessens its value. It is easily lost, broken, spoiled, stolen or mislaid. File-work is not only expensive (as all hand work is) but singularly deceptive. There is nothing a man can dawdle over more, and waste more time on, than work at the vise-bench. To say nothing of the time necessarily lost in clamping and unclamping the work in the vise, the workman may, both honestly and dishonestly, waste his time. He may have a good File and so stint the pressure that he scarcely removes any metal. He may choose the wrong File. There is generally a lot of them littering up the work-bench. The chances are that he spends some time hunting, and then picks up a dull one.

The Tanite Emery Wheel is a Rotary File, which runs a mile in a minute and whose cutting points never grow dull. What the Circular Saw is to the Hand Saw, the Tanite Wheel is to the File. He who equips his workshops with suitably mounted Emery Grinding Machines yokes Steam Engines to his Files instead of men.
THE TANITE CO., Stroudsburg, Monroe Co., Pa.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, Try Street, 2d and 3d Avenues, Pittsburg, Pa. 190 S. Canal Street, Chicago, Ill.
☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass. Geo. Place Machinery Agency, 121 Chambers St., N. Y.

Gear Molding without Patterns

Scott's Gear Moulding Machines,

AIR COMPRESSORS & ROCK DRILLS.
DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
FOOT OF W. 13th ST., North River, NEW YORK.
ESTABLISHED 1841.

BRADLEY'S CUSHIONED HELVE HAMMER
Has More Good Points, Does More and Better Work, Takes Less Power, Than any Hammer in the World.
BRADLEY & COMPANY, SYRACUSE, N.Y.

The George Place Machinery Agency

Machinery of Every Description. 121 Chambers and 103 Reade Streets, New York.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

THE SKINNER PORTABLE & STATIONARY ENGINES & BOILERS & GOVERNORS
FIRST CLASS & ECONOMICAL. SKINNER & WOOD. ERIE, PA.
SEE ILLUSTRATED ADVERTISEMENT

BOYLE ICE MACHINE CO., 10 N. Jefferson St., Chicago, Ill.
The best Ice and Refrigerating Machines of all sizes and for all purposes guaranteed. Send for circular.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

Dead Stroke Power Hammers

are superior to all others for forging and die work. Over 300 now in use. Manufactured by
PHILIP S. JUSTICE, 14 North 5th Street, Philadelphia, Pa.

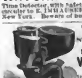
Holly's Improved Water Works.

Direct Pumping Plan. Combines, with other advantages, over older systems, the following: 1. Secures by variable pressure a more reliable water supply for all purposes. 2. Less cost for construction. 3. Less cost for maintenance. 4. Less cost for daily supply by the use of Holly's Improved Pumping Machinery. 5. Affords the best fire protection in the world. 6. Largely reduces insurance risks and premiums. 7. Dispenses with fire engines, in whole or in part. 8. Reduces fire department expenses. For information by descriptive pamphlet, or otherwise, address the
HOLLY MANUFACTURING CO., Lockport, N. Y.

STEAM HEATING APPARATUS ...

WATCHMAN'S IMPROVED

Time Detector, with Safety Lock Attachment. Send for circular to E. IMHAUSER, 212 Broadway, New York. Beware of buying infringing detectors.



The J. L. Mott Iron Works, 88 and 90 BEEKMAN ST., Manufacturers of DEMAREST'S PATENT WATER CLOSETS. Simple in construction, perfect in operation, thoroughly excluding all sewer gas, and cleanly in every way.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO., Publishers SCIENTIFIC AMERICAN.

THE PARAGON SCHOOL DESK AND GARRETSONS EXTENSION TABLE SLIDE
MAN'F BY BUFFALO HARDWARE CO. SWAN ST. BUFFALO N.Y.
SEE ILLUSTRATED EDITORIAL

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

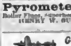
FIRE BRICK. TILE AND CLAY RETORTS ALL SHAPES. BORGNER & O'BRIEN, 23RD ST. ABOVE RACE, PHILADELPHIA.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS.—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

ORGAN BEATTY PIANO ... Address Daniel F. Beatty, Washington, New Jersey.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc. HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.



GRISCOM & CO'S VALVE REFITTING MACHINE, POTTSVILLE, PA.

THE PICTET ARTIFICIAL ICE COMPANY, Limited. Ice Machines to make from 20 pounds per hour to 50 tons per day, at 38 Cortlandt St., New York. P. O. Box 3083.

CARY & MOEN STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. 234 W. 29 ST. NEW YORK CITY

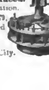
FRIEDMANN'S PATENT INJECTOR.
The best
BOILER FEEDER
in the world.
Simple, Reliable, and Effective.
40,000 IN ACTUAL USE
show how they are appreciated by Manufacturers and Steam Users.
NATHAN & DREYFUS,
Sole Manufacturers, *NEW YORK.*

☞ For improved Blind Staples and Drivers, Rod Cutters, Blind Stile Borers, address B. C. DAVIS, Binghamton, N. Y.

MACHINERY FROM AN INSURANCE Point of View. By H. J. Waters. An able paper, pointing out the various factors which combine to cause a rapid depreciation in the value of all kinds of machinery. Depreciation and fire risks through friction, incompetent workmen, the tension of belting, and dust and dirt. Careful estimates of the amount of depreciation in planing mills; on shafting, hangers, pulleys, and belting; on flouring mills, middlings purifiers, smutters and separators, elevators, cups, and belts, staves and heading factories, and on the heavy machinery used by iron workers. General conclusions of the author as a result of the foregoing study. Contained in SCIENTIFIC AMERICAN SUPPLEMENT Nos. 204 and 205. Price 10 cents each. To be had at this office and from all newsdealers.

THE WATSON ... PUMPING ... PHILA.

VALUABLE PATENT CHEAP FOR CASH. Revolving Sulkey Harrow. Patented 1878. All territory with exception of Kansas and Missouri. Single States or all. Fortune for right parties. Send for circulars. G. H. GABLE, Corpus Christi, Texas.



Leffel Water Wheels,
With recent improvements.
Prices Greatly Reduced.
8000 in successful operation.
FINE NEW PAMPHLET FOR 1879,
Sent free to those interested.
James Leffel & Co., Springfield, O.
110 Liberty St., N. Y. City.

THE TANITE CO., STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES AND AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG MASS.

Lathes, Planers, Shapers
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

DIES FOR EVERY PURPOSE. STILES & PARKER PRESS CO., Middletown, Ct.

Model Engines.

Complete sets of CASTINGS for making small Model Steam Engines 1 1-2 in. bore, 3 in. stroke, price, $4; ditto 2 in. bore, 4 in. stroke, price, $10, same style as cut. Gear Wheels and Parts of Models. All kinds of Small Tools and Materials. Catalogue Free. GOODNOW & WIGHTMAN, 176 Washington Street, Boston, Mass.

50,000 Agents wanted by 1,000 advertisers in the Agents' Herald, Box A, Philadelphia, Pa.

BARNES' PATENT FOOT POWER MACHINERY. CIRCULAR SAWS, SCROLL SAWS, LATHES, FORMERS, MORTISERS, TENONERS, &c., for actual workshop business. COMPLETE OUTFITS for Mechanics and Amateurs. MACHINES ON TRIAL IF DESIRED. Say where you read this and send for Descriptive Catalogue and Price List. W. F. & JOHN BARNES, Rockford, Ill.

WM. A. HARRIS, PROVIDENCE, R. I. (PARK STREET), Six minutes walk West from station. Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.

BROWN'S PAT. SPLIT PULLEYS
Shafts, Hangers
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

1880. 1880. 1880.

The Scientific American FOR 1880.

THIRTY-FIFTH YEAR.

VOLUME XLII. NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Third day of January, 1880, a new volume was commenced. It will continue to be the aim of the publishers to render the contents of the new volume as attractive and useful as any of its predecessors.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

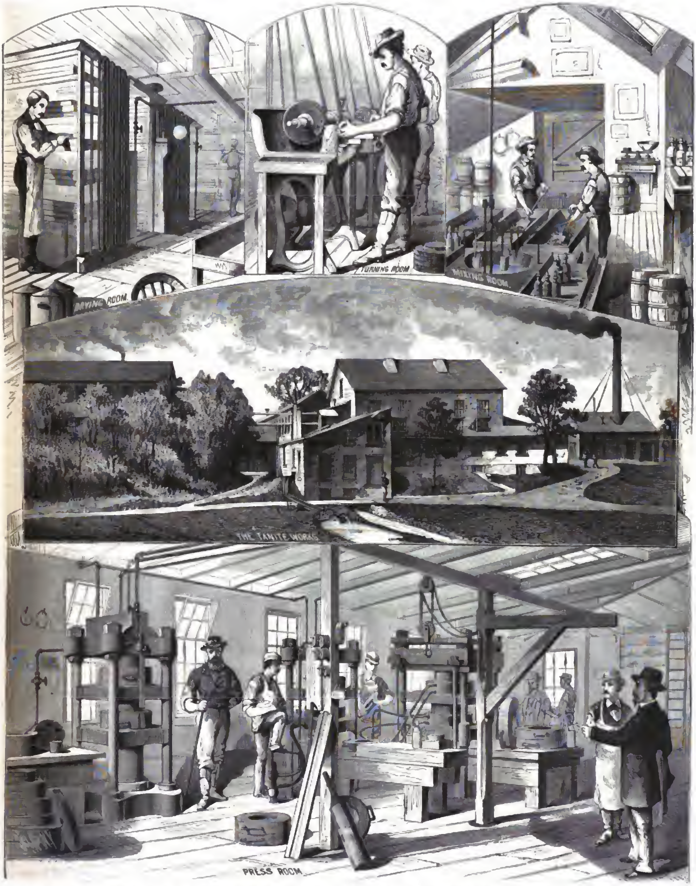
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 8. [NEW SERIES.] | NEW YORK, FEBRUARY 21, 1880. | $3.20 per Annum. [POSTAGE PREPAID.]



THE MANUFACTURE OF SOLID EMERY WHEELS.—WORKS OF THE TANITE COMPANY, STROUDSBURG, PA.—[See page 117.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, FEBRUARY 21, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 216.

For the Week ending February 21, 1880.

Price 10 cents. For sale by all newsdealers.

MR. CONVERSE'S PATENT BILL.

In our issue of January 17, the bill introduced in the House of Representatives by Mr. Converse, of Ohio (H. R. No. 2,913), was reprinted as it was received from the government printer. The author of the bill now informs us that by a clerical error the words "who shall knowingly violate the provisions of this act," had been omitted from the final clause as officially printed, and that the bill properly reads as follows:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That it shall be unlawful for any owner, or part owner, or assignee of the whole or any part of any patent granted or pending under the laws of the United States, to charge or receive as royalty on such invention or discovery more than an amount equal to the cost of production, and twenty-five per centum to be added thereto for profits of manufacture in addition to such cost, and twenty-five per centum profit. Whenever the invention or discovery or the article patented, or when patent is applied for, is used for hire instead of being sold, it shall be unlawful to charge or receive for such use more than the royalty, cost, and profit of manufacture aforesaid. Every owner or part owner, by assignment or otherwise, of any patent heretofore or which may hereafter be granted, or for which application is pending under the laws of the United States, who shall knowingly violate the provisions of this act, shall forfeit to the public all right to said discovery or invention."

In this form the bill is worthy of serious consideration as a fair representative of a large class of well-intentioned but mistaken efforts to regulate the business affairs of patentees.

In discussing the relation between those who make and those who use inventions, many are apt to overlook the fundamental facts of the case; among them these:

1. To live, an invention must be of practical utility. If it is useless it is dead to begin with, and since the fees paid for a patent on such an invention more than cover the cost of issuing it, no one but the inventor loses by or because of its inutility.

2. An invention lives and pays when it furnishes a product which is novel and useful; or when it improves the quality or usefulness of some product already in use; or when it improves or cheapens the methods of producing some existing article; or when it facilitates (like the telephone) the necessary intercourse of men. In each and all of these cases the maximum price of the invention or its product is fixed not by the inventor, but by the public need. It is impossible for an invention to increase the price of anything already in use, for in that case no one would abandon the old and buy the new. For an entirely novel article the public will pay no more than it is worth to them. If the inventor charges more than that he cannot sell. However large the profit which accrues to the patentee the public is of necessity benefited more or less immediately, and ultimately it receives the entire benefit which the invention is capable of yielding.

3. The larger the immediate profit to the inventor the greater the practical value of the invention, and the greater also the legacy which falls to the public when the brief term of the patent expires.

4. The object of the patent law is to hasten the development of the useful arts by holding out inducements to all men to exercise their inventive faculties and publish the results of their labors. These inducements cost nothing to the community, and in the aggregate they yield to the nation large benefits directly and indirectly.

5. The experience of the past century proves that it pays to encourage invention as a means of advancing the useful arts. It proves, moreover, that it pays to encourage invention by giving the fullest protection to the inventor's constitutional property rights. Where inventors have been most liberally treated, there their work has been most active and beneficial, and there social and industrial progress has been most rapid.

In view of these fundamental facts, any attempt to arbitrarily interfere with the property rights of inventors and patentees, or to arbitrarily limit their profits, is objectionable for such reasons as these:

1. The act would be one of gross injustice.

2. The act would be impolitic and contrary to public interest.

3. The attempt to limit the price of patented articles by such means would be entirely futile.

The injustice of the act lies in its unwarranted discrimination against the holders of one particular kind of property. There is no species of property which is more honorable to the holder, or which has contributed more to determine the character of modern life and to advance the wealth, power, and industrial supremacy of the American people, than that which is or has been covered by or developed under patent rights for invention. By a single achievement the inventor not unfrequently creates or makes available in the course of a few years more power and more wealth than a million other men can produce by a year of hard work on the farm or in the factory. By far the larger part of such created wealth and power accrues not to the inventor, but of necessity to the nation at large. Still the inventor's possible reward is great (and this is the chief incentive which urges men on to invent), but the greatness of a man's profit in other lines of endeavor is not made a pretext for public interference and legalized robbery. Some lawyers make enormous gains from their professional practice. Would that fact justify a law to the effect that no lawyer should receive for his services in any year more than twice the earnings of a hod-carrier, plus twenty-five per cent for professional profit? What would farmers and stock raisers say of a law which should forbid their selling a specially promising colt, or a bull of superior stock and breeding, for more than twice the average price of animals of the kind, with twenty-five per cent added for breeder's profit? What would any man in any profession, business, or art say of a law arbitrarily limiting the profit he might make from his genius, or skill, or patient labor, or fortunate investments of any sort? If such interference would be unjust in the case of the farmer, the miner, the professional man, the artist, or any other, it is not less an injustice to the inventor.

The attempt to limit arbitrarily the inventor's profit in his invention would be bad policy in that it would remove the great incentive to invention, and still worse, it would tend strongly to suppress useful inventions should such be stumbled upon. If men were deprived of the possible hope of making a rapid fortune through successful invention they would not toil on year after year, in poverty may be, to achieve some grand result. Besides the more profitable the invention to the inventor, the greater generally is its value to the community, in the long run if not immediately. But this law would make a poor invention or slight improvement more profitable to the inventor than a great one. The greater the economy effected by an invention the smaller, under such a law, would be the inventor's percent age of profit, thus placing an indirect penalty upon successful invention as marked as the penalty for thrift upon the worst managed Irish estate. Said a tourist to a wretched cottager at the door of his hovel, "Why don't you mend your roof and make your place more tidy and comfortable and wholesome?" "What!" was the reply, "and have the landlord raise me rint!"

The law as proposed would be futile: first, because of its vagueness; second, because, though it attempts to limit the profit of the inventor and maker of patented articles, it in no way touches the profit of the dealer.

The bill limits the rental of patented articles and processes to two and a half times their cost, but it does not say how that cost is to be determined or for what period the rental is to be paid. Some things are rented by the hour, some by the day, some by the year. For what length of time is the prescribed rental to be charged? Again, by strict and skillful economy a manufacturing inventor may turn out an article at the cost say of one dollar. His royalty and profit would then be limited to a dollar and a half. Suppose he chooses not to be so very skillful, but makes the cost of production two dollars, increasing his legal royalty and profit to three dollars. How could Mr. Converse help himself? And how many radically novel and economical processes would the public ever hear of under such a rule?

But suppose the inventor or manufacturer too honest or too stupid to study his own interest in that way, what is to hinder the jobber from doubling, trebling, or increasing a hundred fold the price of the patented article, irrespective of the maker's profit, except the limit of price which the public desire or need determines? If an article is worth ten dollars a year to the user, and there is no cheaper substitute, that fact will ultimately fix its price whatever may be its original cost. To arbitrarily limit the profit of the inventor and manufacturer, therefore, simply takes what properly belongs to them and gives it to the go-between, who has certainly done nothing to justify such a discrimination in his favor.

Though these remarks have been so far extended, we feel that we have but barely touched upon or hinted at the more obvious objections to the law proposed in this bill. There is scarcely a field of productive effort in which its injustice and unwisdom would not work mischief if it could be enforced, and the attempt to enforce it would be scarcely less mischievous.

"HOW STEEL HARDENS."

The above is the title of a paper read before a recent meeting at Pittsburg, of the Engineers' Association of Western Pennsylvania, by its President, Mr. William Metcalf, who is also a prominent steel manufacturer of Pittsburg. The gentleman has for years expended thought and time upon the topic, assisted in the chemical bearings of the subject by Professor Langley, of Ann Arbor, Mich. The paper awakened a deep interest among the iron and steel men of Pittsburg, and is an exhaustive treatise. The conclusions arrived at by Mr. Metcalf and Mr. Langley are embodied in the concluding portion of the paper, in which the authors express the opinion that it has been clearly shown:

First—That a good soft heat is safe to use, if steel be immediately and thoroughly worked. It is a fact that good steel will endure more pounding than any iron.

Second.—If steel be left long in the fire it will lose its steely nature and grain, and assume the nature of cast iron. Steel should never be kept hot any longer than is necessary for the work to be done.

Third.—Steel is entirely mercurial under the action of heat, and a careful study of the tables will show that there must, of necessity, be an injurious internal strain created whenever two or more parts of the same piece are subjected to different temperatures.

Fourth.—It follows that when steel has been subjected to heat not absolutely uniform over the whole mass, careful annealing should be resorted to.

Fifth.—As the change of volume, due to a varied degree of heat, increases directly and rapidly with the quantity of carbon present, therefore high steel is more liable to dangerous internal strains than low steel, and great care should be exercised in the use of high steel.

Sixth.—Hot steel should always be put in a perfectly dry place of even temperature while cooling. A wet place in the floor might be sufficient to cause serious injury.

Seventh.—Never let any one mislead you with the statement that his steel possesses a peculiar property which enables it to be "restored" after being burned. No more should you waste any money on nostrums for "restoring" burned steel. We have shown how to restore "overheated" steel. For burned steel, which is oxidized steel, there is only one way of restoration, and that is, through the knobbling fire or the blast furnace. Overheating and restoring should only be allowable for the purpose of experiment. The process is one of disintegration, and is always injurious.

Eighth.—Be careful not to overdo the annealing process; if carried too far, it does great harm, and it is one of the commonest modes of destruction which the steel maker meets in his daily troubles. It is hard to induce the average worker in steel to believe that very little annealing is necessary, and that a very little is really more efficacious than a great deal.

Finally, it is obvious that, as steel is governed by certain and invariable laws in all of the changes mentioned, which laws are not yet as clearly defined as they should be, nor as they will be; nevertheless, the fact that there are such laws, should give us confidence in the use of the material, because we may be sure of reaching reliable results by the proper observance of these laws. Therefore there is no good reason why engineers should be afraid to use steel if they manipulate it intelligently. Now, if we have wandered over a wide range in answer to the simple question, "Why does steel harden?" it was necessary to have looked at many facts before we could have an intelligent opinion of many theories; and if any are in doubt as to what is the correct answer to this momentous question, we only say that we are all "in the same boat," for if you do not know, neither do we."

APPROXIMATE ECONOMY OF GAS AND ELECTRIC LIGHTING.

It is not in every place or position that the electric light can be employed in lieu of gas; but under some circumstances, for example, in spacious apartments, where large numbers of gas lights are used, the electrical method of lighting may now be adopted with satisfactory success. Under such conditions, and with gas costing the excessively high prices that we are accustomed to pay, the superior economy of electricity over gas has been conclusively settled on this side of the Atlantic. We might cite various examples, but for our present purpose one will be enough, to wit, the Riverside Worsted Mills, Providence, R. I., where the Brush electric lights have been in regular use for about one year past—long enough to determine their actual expenses and merits.

In one portion of the above mills 1,000 gas lights were used, each of 15 candles intensity, yielding an aggregate of 15,000 candles, and costing $12.25 per hour to run them, or 0·83 of a cent per candle per hour.

We are not informed as to the exact cost of the gas per 1,000 cubic feet, but we figure it to be $2.45.

In lieu of the above 1,000 gas lights 80 electric lights were substituted, each of 2,000 candles intensity, yielding an aggregate of 160,000 candles, and costing 80 cents per hour to run them, or 0·05 of a cent per candle per hour.

If we have not been misinformed as to the above estimates of costs and intensities, it would appear that gas lighting, at the mills named, was at least sixteen times more costly than electric lighting, quantity of light produced being considered.

It may not be uninteresting briefly to compare the probable economies of Mr. Edison's new system of lighting with the foregoing results.

Mr. Edison's method has, to be sure, as yet only reached the stage of experiments. But it must be remembered that his trials have been made on an extensive scale, with full-sized electrical machines and apparatus, expressly with a view to show and determine what the practical introduction of the invention, wherever used, would accomplish. We have his authority for saying that the generous sum of one hundred thousand dollars in cash was placed at his free disposal, by his associates, to be used as he saw fit for these grand experimental demonstrations.

In a word, Mr. Edison's plan is to furnish small electrical lamps, each having the intensity, he tells us, of an ordinary gas light of fifteen candles, burning five cubic feet of gas per hour. He states that he gets ten lamps, or 150 candles, of light per hour per horse-power of engine; and that each of his new electrical machines furnishes 750 candles of light and requires five horse power to drive it.

Applying the Edison system to the Riverside Mills and to the replacement of the 1,000 gas lights, we have the following approximate results:

Number of Edison lamps required, 1,000; number of Edison machines required to run the lamps, 20; engine power needed, 100 h. p. Approximate cost of the Edison plant, $16,000. Approximate cost of running the same, delivering 15,000 candles of light per hour, including 6 per cent. interest on the plant, $1.66 per hour, or 0·11 of a cent per candle per hour. This estimate allows no royalty to the owners of the patents. Thus the approximate cost of gas lights at the Riverside Mills is seven and a half times more than the same quantity of light would be under the Edison system. And the cost of the Edison system would, approximately, be two and one-fifth times more than the cost of the same quantity of electrical light as delivered by the present Brush machines.

Side by side the fractions stand as follows:

Approximate costs of lighting per candle per hour:

Gas Lights.	Edison Lights.	Brush Lights.
$\frac{83}{100}$ of a cent.	$\frac{11}{100}$ of a cent.	$\frac{5}{100}$ of a cent.

THE CORUNDUM MINES OF NORTH CAROLINA.

The name "corundum" is applied to all crystallized alumina. It is the hardest mineral in the world, except the diamond, and when in the crystalline form and transparent, constitutes the Oriental gems, the sapphire, ruby, emerald, topaz, etc., which are of great value, some even exceeding the diamond, because they are more rare. It is used for abrasive purposes, but as yet a sufficient quantity has never been found in this country to take the place of emery. It is much harder than emery, performing the work in less time.

Corundum occurs in the great chrysolite belt extending from the southern part of Virginia to middle Alabama, passing in a southwesterly direction through the mountainous portion of North Carolina. In the southwestern counties in the Nantahala range of mountains (one of the spurs of the Blue Ridge), and lying on either side of Buck Creek (a tributary of the Tennessee), at an elevation of from three to four thousand feet in the so-called Cullakenee corundum mine, which has been considered the largest deposit of corundum in this country. It covers an area of three hundred acres. This mine was purchased in April, 1879, by Herman Behr & Co., and has been worked since May, with what success is not reported.

In Macon county, N. C., on the western slope of the Blue Ridge, at an elevation of about twenty-five hundred feet, is Corundum Hill, formerly known as Cullasagee mine. This mine was discovered in 1872; it was afterwards purchased by E. B. Ward, and worked for eighteen months by Col. C. W. Jenks, of Boston. Rumor says that gems of exceeding great value were taken out. In July, 1878, this mine was purchased by Dr. H. S. Lucas, for the Hampden Emery Co., of Chester, Mass. They commenced mining August 20th, and up to the present time have taken out two hundred tons of corundum; also, in washing some of the dumps left there when worked by Col. Jenks, were found many fragments of the Oriental gem, perfectly transparent and of very great brilliancy. Among these is an emerald weighing 30½ carats, and several rubies of the finest color.

In the eastern part of Jackson county, N. C., at the foot of one of the highest peaks of the Blue Ridge, is what is termed the Hog Back mine. This mine was operated for a limited season by the Hampden Emery Co.

Northwest of the Pigeon, in Heywood county, N. C., is still another deposit of corundum, called the Presley mine, which has been worked since one year ago last March.

In Madison and near the Buncombe county line, in the same State, is an outcropping of chrysolite, carrying corundum, which covers an area of seventy-five acres, and has been worked for the Hampden Emery Co. for the past season.

Deposits of corundum are also found in South Carolina, Georgia, and Alabama, notices of which we intend to present hereafter.

WHY THE THUNDERER'S GUN BURST.

Our readers will remember that about a year ago a 38-ton gun on board the British ironclad Thunderer burst, killing a number of men and wounding many more. A committee, appointed to investigate the disaster, came to the conclusion that the explosion was caused by a double charge. The gun, having missed fire when loaded with a battering charge (a 700 pound projectile and 110 pounds of powder), was again loaded with a full charge, and fired with both of the charges and the projectiles in the gun at the same time. This decision having been seriously questioned, the government ordered an experimental test by loading and firing the sister gun in the manner alleged. The test was made at the proof butts adjoining the Royal Arsenal at Woolwich, February 3. The second 38-ton gun was loaded and fired with a double charge of 80 and 110 pounds of powder, one 600 pound shell and one 700 pound Palliser projectile. The gun burst as its fellow did on board the Thunderer, thus justifying the opinion of the committee of investigation as to the cause of that disaster. The muzzle of the gun and the projectiles were buried in the sand at the proof butts. The remainder of the gun, with the exception of its base, was blown to atoms.

ARTIFICIAL ICE SKATING RINK, NEW YORK.

Among the new structures lately erected in this city is a skating rink, occupying the westerly portion of the square at the junction of Madison avenue, 58th and 59th streets. The building is of brick. The central portion of the inner space is occupied by an unbroken sheet of ice two hundred feet long and forty feet wide. Surrounding the ice sheet, and on a higher level, is a spacious gallery for visitors. Altogether the establishment is a place of considerable attraction, especially for skaters; and the present winter has been a particularly fortunate one for the proprietors, for the weather has been so mild here that up to the time of this writing the lakes in Central Park and other places have not been sufficiently frozen for safe skating.

The ice sheet formed in the new rink is produced under the patents of Mr. Thos. L. Rankin, whose various inventions in the manufacture of ice and refrigerating machines have heretofore been noticed by us. We believe he was the first to succeed in artificially producing with economy large permanent sheets of ice for skating rinks. At the new rink in question the ice is formed in the following manner:

A shallow water-tight basin is first prepared, in which a network of ordinary iron pipes are laid, divided into valved sections. Water is admitted to the basin, so as just to cover the pipes. A refrigerating liquid, consisting chiefly of salt water, is introduced within the pipes, and, by means of a steam pump, forced to circulate through the pipes and through a suitable refrigerating apparatus placed at a little distance from the basin. The liquid, in passing through the refrigerating apparatus, is cooled down fifteen or twenty degrees below the freezing point, and this cold liquid, when forced through the network of pipes, soon causes the water in the basin to freeze into a solid sheet. In order to renew the surface of the ice after it has been cut up by the skaters, the surface is swept off and a thin film of fresh water put on the ice by hose pipes. This film soon congeals, and a new, smooth surface is ready for visitors. The renewals are generally made at noon time and between six and seven P.M. The rink is open during the day and evening, and is generally full of visitors and skaters, and forms an interesting addition to the various entertainments of this great city.

Test Trials of Steam Engines.

Among the interesting features of the forthcoming Millers' International Exhibition at Cincinnati, June, 1880, will be a test trial of automatic cut-off steam engines. We publish in this week's SUPPLEMENT the full code of regulations for this trial, as prepared by the Chief Engineer, Mr. John W. Hill, C.E. Every precaution which experience could suggest appears to have been adopted by the engineer in preparing the regulations to render the tests impartial and effective. These trials will doubtless yield much useful and instructive information concerning the latest improvements and economies in steam engineering.

A Belgian Prize.

The yearly prize of $5,000 (25,000 francs) offered for international competition in works of intelligence, by the King of Belgium, will be granted in 1881 to the best treatise on means of improving harbors on low and sandy coasts. Essays for competition must be submitted to the Ministry of the Interior at Brussels, before January 1, 1881. The decision will be made by a jury of seven—three Belgians and four foreigners of different countries. This competition is worthy of the attention of American engineers for its own sake, as well as for the benefits likely to flow therefrom to many of our Atlantic ports, which present problems not unlike those of the ports of Belgium.

Melting Street Snow by Steam.

It has often been proposed to use steam to fuse snow in the streets. A correspondent of *La Nature* endeavors to prove, by a few simple figures, how impracticable this idea is. He finds that every square meter of street covered with a layer 5 c.m. in thickness would require 3,000 calories to fuse the snow on it, and that the locomotive could only fuse, *at the maximum*, the snow covering 54 square meters per hour. With a width of 15 meters this represents a theoretical advance of less than four meters (13 feet) in an hour.

New Astronomical Instruments.

At a recent meeting of the French Society of Civil Engineers, M. Saubert presented several of the instruments already made, and designs of others, for the great popular observatory which has been projected. A large variety of telescopes of all dimensions, and of new modes of mounting, was exhibited. The total of instruments was about 100; more than 20 have been already made. Among the telescopes planned, one with an object glass one meter in diameter excited much interest. This is intended to project on a screen, before a thousand persons in a hall like that of the Trocadéro, an image of the sun or of the moon with much detail; also planets, groups of stars, double stars, and perhaps even nebulæ. M. Saubert is assisted in his work by several young astronomers.

A New Use for the Telephone.

Hitherto it has been a matter of some difficulty to determine the time of flight of small-arm projectiles, owing to the impossibility of seeing them strike. In a series of experiments made by the U. S. Ordnance Department this difficulty has been overcome by the use of the telephone. The telephone was connected with two Blake transmitters, one placed near the gun, the other in front of and near the target. The time between the report of the gun and sound of the ball upon the target was measured by a stop-watch. The observations, founded on a large number of experiments, never differed more than a quarter or half of a second from each other, the slight delay in starting the watch being neutralized by the delay in stopping it. It was found that the time of transit was affected by the wind, being shortened by a rear and lengthened by a head wind.

Telegraphic Communication with South Africa.

Cape of Good Hope has been brought into telegraphic communication with England by the successful completion of the cable between Aden and Zanzibar. The first messages were transmitted between Queen Victoria, the Sultan of Zanzibar, and the Governor of the South African Colonies, December 25.

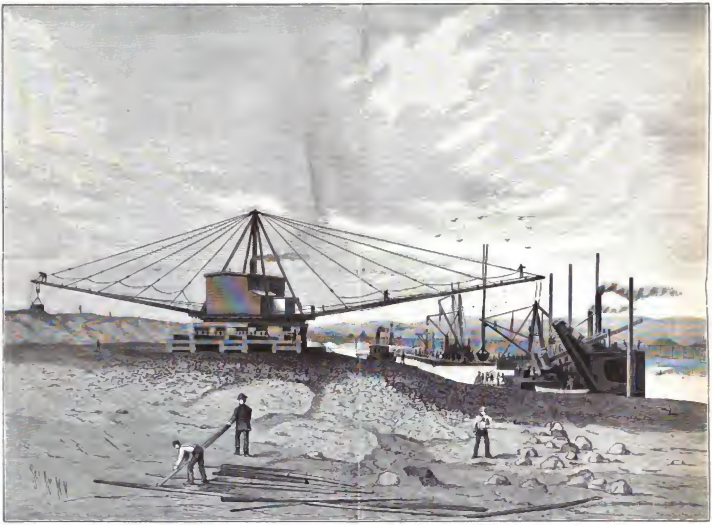
IMPROVED REVOLVING DERRICK.

This important improvement in the economy of hoisting and removing earth, rock, or other material, has now been in use for some two or three years on the work of the inventors, who are contractors on the "Quebec Harbor Improvements." It consists, essentially, of a circular platform mounted upon wheels which run upon a circular track. This circular platform carries two or more booms, arranged symmetrically, and combined with suitable hoisting apparatus for raising material upon one side and moving it to any point within the sweep of the boom. The circular platform of the derrick now in use is forty feet in diameter, with a mast thirty-eight feet high, and booms of one hundred and ten feet each, thereby making the total swing of the derrick two hundred and twenty feet. The revolving machinery consists of a pair of 6 x 10 cylinders, connecting by bevel gearing with a vertical shaft, at the lower end of which is a pinion working with a circular rack of 12 feet diameter. This pinion is held securely in gear by the steadiness of the circular platform upon its track, and is not affected by any slight vertical motion of the platform. The hoisting is done by an additional pair of engines, 8 x 14 cylinders, connecting with two friction drums working independently, thus enabling the operator to hoist and revolve the load simultaneously.

The circular track is laid with steel rails and is firmly supported upon the lower platform, which is of sufficient strength to resist the great weight and strain brought upon any given point. The step or socket at foot of the mast consists of heavy bearing plates with a central orifice adapted to conical rollers upon which the mast rests. The booms are supported upon the platform, the inner end resting in a socket at the foot of the mast. They are suspended by wire ropes from head of the mast and secured against lateral strain by guys connecting with the platform. Obviously the weight of the structure rests mainly upon the circular track, and when any one of the booms is loaded the wheels and the rollers upon which they rest on the loaded side form the support for the said load, and become the fulcrum over which the loaded boom acts as a lever, the whole circular platform and opposite boom serving as counterbalancing weights to hold the platform in place and enable it to securely carry the load.

Heretofore, although derricks have been in common use for hoisting heavy materials and transferring them over short distances, as from the wharf to shipboard and the reverse, the only practical way which has been found for removing heavy masses of earth or other material to any considerable distance has been the laborious and expensive method of carting or wheeling.

By the revolving derrick material can be hoisted to any desired point, and removed horizontally from two to four hundred feet, for it is plain that by increasing the circular platform and elongating the mast the sweep of the booms can be readily extended to the latter distance. The derrick can be worked and moved from point to point either by means of crib-work or piles and ordinary railroad track, or by a suitable float. The present derrick has been used chiefly for removing material directly from a dredge of a working capacity of some 1,200 cubic yards per day, a full load of the dipper or bucket being about 4½ tons, but bowlders weighing over 8 tons have frequently been removed without the slightest injury to any part of the machinery. The working capacity of this derrick may be fairly stated at 50 revolutions per hour.



MOORE & WRIGHT'S REVOLVING DERRICK.

The Science of War.

The "science of war" means something more than it used to, when war was merely the opposing of brute force with brute force. An illustration of what it now implies is furnished by the *Avenir Militaire*, in an account of the apparatus employed in French gunnery practice, for the translation of which we are indebted to the *Iron Age*.

The force and velocity of the wind is first measured by an anemometer. Then the weight of the atmosphere must be determined by a barometer, because sights adjusted to a certain barometric pressure must be changed if the pressure varies. Next a hygrometer is used to determine the amount of moisture in the air, as this determines to some extent the resistance encountered by a projectile in its flight. If the object aimed at is out of sight, the use of the plane table or planchette is necessary. Then the gunner must employ the telemeter to measure the distance of the object to be struck, and when all preparations are made he consults the thermometer to see what the temperature is, since allowance must be made for contraction and expansion of the metallic sights. He is then ready to blaze away, but how many instruments he needs to determine the course of his projectile and the effect of his shot we do not know.

With such refinements in gunnery, we should think it would not much longer be necessary to kill men, although it is probable that some mortality will result from trifling errors in calculation, or because the soldiers shot at will not stand still while the gunner is calculating his aim. All that is desired by the most bloodthirsty enemy is to place as many as possible of the opposing force *hors de combat;* then scientific surgery comes in, and it will soon be that, if enough pieces can be collected, the worst wounded men can be put together and patched up so as to be almost as good as new in a few months. It is at least satisfactory to know that the greater the progress in scientific warfare and in the improvement of arms, the fewer are killed and wounded in battle. In the days when opposing forces used to stand at arm's length and hack each other to pieces with short swords and axes, very little was known about the science of war; but more men were often killed in a day than could now be brought into the field by any but a first-class military power. Perhaps it will come some day that, instead of making war, the powers at variance will merely send each other a statement of their military preparations, whereat the weaker power will make the necessary concessions.

Influence of Watering on the Germination of Seed.

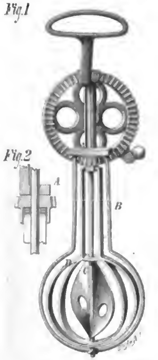
In his researches upon this subject, Professor Just has found that seeds which have been thoroughly dried for a long time can be raised to a temperature of 120° C. without losing their germinative power, if only they be *slowly* exposed to moisture. But if their thoroughly dried-up protoplasma is suddenly drenched with water they are killed, in just the same manner as frozen plants are killed if too suddenly thawed. To favor the rapid introduction of water in the course of his experiment, Professor Just bored holes in grains of wheat, an operation which under ordinary circumstances does not affect the germinative power of more than 15 or 20 per cent of the grain thus treated. These seeds were then carefully dried at 30° to 40° C. over sulphuric acid or chloride of calcium, and one portion of them slowly moistened, while the other was quickly impregnated with water. Of the latter only from 10 to 15 per cent retained their germinative power, while of the former it was destroyed in only about the same proportion of cases.

IT is a curious fact that in some lines of manufactures the Canadians are beating the Yankees in economy of production. For example, the Waterous Manufacturing Company, of Brantford, Ontario, have, we learn, for some time past been delivering steam engines in Bremen at less prices than the American makers can put them down there.

BLACKING.—Mix intimately 1 pound of molasses, 1 pound of best bone-black in very fine powder, and ¼ pound olive oil; then add ¾ pound sulphuric acid, previously diluted with ¾ pound water. The whole is allowed to stand for three hours or longer, and afterward as much water is added as is necessary to give it the proper consistence.

NEW EGG BEATER.

The accompanying engraving shows an improved egg beater recently patented by Mr. Harry C. Mann, of 4850 Cherry St., Frankford Pa. While the egg beater in some respects resembles others in market, it differs from them in important particulars. It is so simple and well designed that the parts may be easily made and readily put together without special machinery or skilled labor. The essential feature of this invention is the perforated spiral



MANN'S IMPROVED EGG BEATER.

disk secured to the central spindle and forming a screw or propeller-shaped blade, which renders the device very efficient. The egg beater is shown in perspective in Fig. 1, and Fig. 2 is a detail view of the lower spindle bearing, showing connection of the lower pinion with the beater, D.

On the lower end of the handle there is a cross piece, to which the ends of the wire, B, are secured. The center of the wire, B, is formed into a coil or eye forming a bearing for the lower end of the spindle, C. The latter has near its lower end a perforated metallic disk, and at the top a pinion which is engaged by the driving wheel. The perforated disk is twisted, forming a propeller wheel, which, together with the curved strip, D, rapidly and thoroughly beat the eggs. The bent strip, D, is connected with a pinion placed loosely on the spindle, C, and meshes into the drive wheel. By this arrangement the two movable parts are driven in opposite directions.

NEW AGRICULTURAL ENGINE.

The annexed engraving represents a very compact and simple agricultural engine made by G. Westinghouse & Co., of Schenectady, N.Y. This engine, in its general design and in the details of its construction, seems well adapted to work for which it is intended. It is very light, weighing complete but 3,800 lb., and its economy in the consumption of fuel is worthy of special mention, as it consumes only 500 lbs. of coal per day when working 10 horse power.

This engine has an upright boiler shell, but it is not open to the objections usually brought against upright boilers. The tubes in this boiler are horizontal, and so arranged that they are filled with water so that a constant circulation is maintained in them. The difference between this and boilers having vertical tubes is material; the danger of burnt tubes and crown sheets is avoided, and by reason of the small volume of water contained in the tubes, steam is made rapidly. The circulation of the water in the tubes tends to keep them free from sediment, and they do not become incrusted with scale. The boiler may be easily taken apart at the junction of the upper shell and fire box, and this being done, the tubes are all exposed and the inner surface of the boiler placed within reach for cleaning or repairs.

The boiler is surrounded with a sheet iron casing, leaving a space between it and the boiler shell. This space acts as a flue for conducting the waste heat from the fire box, and affords complete protection against condensation, and in addition to this it receives and extinguishes all sparks coming from the fire. No screen is required in the stack, and the annoyance resulting from screens becoming clogged, and the temptation to remove or open them in order that sufficient draught be obtained, are avoided.

The manner in which the engine and boiler are connected is clearly shown in our engraving. The bed or frame contains the heater, and is securely bolted to the fire box portion of the boiler. The engine has its cylinder, steam chest, guides, and main boxes all in one solid casting, and having all the work relating to the lining of the cylinder and main bearings done from a single position, absolute truth of all working parts is assured. The engine and its bed being connected with the lower part of the boiler, the greatest weight is below the center, and takes away all danger of turning over while on difficult roads. All parts of the engine are accessible from the ground and can be seen by the operator. Every desirable appliance for rendering the engine efficient, durable and convenient has been supplied. A blower and variable exhaust nozzle furnish means for regulating the force of the draught, and for making steam rapidly when required.

An ordinary team can handle this engine easily over common roads even with a full supply of water. Economy in the use of fuel and water is an important point to be considered by both the owner of an engine and by those who employ him, for there are but few places where fuel is too plenty, and in many places water is scarce or has to be drawn so far that it becomes important to make all the saving possible.

Systematic and thorough tests made with this engine have shown that less than 500 lb. of good coal and 350 gallons of water were sufficient to make steam for ten horse power, ten hours, as against 800 to 1,000 lb. of coal and from 400 to 450 gallons of water required by the average engine to accomplish the same work.

THE NEW WESTINGHOUSE AGRICULTURAL ENGINE.

Warmth and Energy.

In ancient times, energy of mind and strength of body were supposed to be the effects of warmth, while depression of spirits and bodily weakness were ascribed to cold. Modern science has explained and modified these theories concerning the production of physical and psychical force, but in the main it has confirmed the principle of causation. In a general sense, it may be said that animal heat, when duly generated within normal limits, is the concomitant of vigor. Practically, therefore, warmth is to be sought and cold avoided; but with this qualification, that the heat must be elicited by organic processes going on within the body, and not borrowed from without. The chief, if not the only use of wraps and "warm" surroundings is to avoid the loss of animal heat by abstraction. It is neither scientific nor hygienic, in any true sense, to trust to external sources of supply for the warmth we require to live well, happily, and usefully. The food is more than the raiment, and those who desire to help the poor and melancholy over their "dead points" in the course of life should be chiefly anxious to feed them well and sufficiently. So in the management of self—to live well is to feed appropriately. Stimulants do not give strength, because they cannot add to the normal and healthy sources of animal heat. Nutriment is the only true fuel.—*Lancet.*

LIFE PRESERVER EXHIBITOR.

Some time since we pointed out the necessity of making known the whereabouts of life preservers on board vessels, and of informing the public how to apply them so that in cases of accident they may be readily found and properly applied. Mr. C. C. Delhommer, of Carencro, Lafayette Parish, La., in response to the suggestion, devised and patented the exhibitor shown in the annexed engraving. It consists of a water tank made in the form of a human figure, having applied to it a life preserver in the position

DELHOMMER'S LIFE PRESERVER EXHIBITOR.

in which it should be worn. The water tank is an indispensable article on the vessel, and as it must of necessity be frequently visited by the passengers, the manner of applying the life preserver will be often seen, and the public will soon gain an accurate idea of the proper way of putting them on.

Most vessels have life preservers conspicuously labeled so that they may be readily found, but there are many people who would be entirely at a loss to know just how to apply them without some sort of instruction. The device shown in the engraving is a mute but efficient teacher ever on duty and within sight of the passengers. We are informed that Mr. Delhommer has taken steps to bring this invention to the notice of the proper authorities. Certainly too much cannot be done in this direction.

AGRICULTURAL INVENTIONS.

Mr. Charles A. King, of Cheshire, Ohio, has patented an improved machine for digging potatoes, which is so constructed as to dig the potatoes, separate them from dirt, clods, etc., and deposit them in a box or basket.

Mr. William R. Iles, of Fairmount, Ill., has invented an attachment to corn planters for dropping and marking the corn in perfect check row. The attachment has more especial adaptation to that form of corn planter in which two thin blades or runners are arranged on each side of the tongue so as to rest upon and run on the ground, which runners or blades are connected to a suitable framework and terminate in the rear in vertical spouts extending from the seed boxes, from which seed boxes and down which spouts the corn is dropped by the reciprocation of a slide extending from one to the other of said boxes.

Mr. John W. Fields, of Sherman, Texas, has invented a device for supplying water and air to the face and land side of a mould board, to prevent the earth from adhering to them. It consists in perforating the mould board and land side with small holes, and attaching to the back of the mould board a water reservoir and a piston and pump or other device for forcing water and air through the perforations, so as to lubricate the faces of the plow, and thus prevent the adhesion thereto of earth.

Mr. Auguste N. Verdery, of Atlanta, Ga., has patented an effective machine for threshing the heads of standing grain and cleaning the grain by a blast produced by the thrashing mechanism. It consists in combining with a reel and a case, having mouth or inlet for the grain in the straw, a cylinder having teeth adapted to give a shear cut and gather the heads inwardly toward the middle of the cylinder.

Mr. James B. Taylor, of West Hurley, N. Y., has patented an improved machine for digging potatoes, and which may also be used for loosening the soil and destroying grass and weeds between the rows.

Mr. Joseph Lane, of Chicago, Ill., has patented a rolling colter for plows, which consists in combining with a mould board plow a rolling coulter made dished or concaved on the mould board side, whereby the straw, grass, and manure are not only cut, but are turned over so that they will be completely covered by the plow.

Mr. Jesse A. Kirkpatrick, of Cartersville, Ga., has patented a seed planter adapted for planting cotton seed and all kinds of smooth seed, such as peas, beans, corn, wheat, etc. The invention consists in the combination and arrangement of parts, which cannot be clearly described without engravings.

Correspondence.

On the so called "Crystallization of Canada Balsam" and how to Make Ornamental Picture Frames.

To the Editor of the Scientific American:

In your last issue you publish an article by Mr. Geo. M. Hopkins, who, writing on the above in answer to a statement made by Professor Barker, holds that he does not "think that the beautiful arborescent forms are anything more than cohesion figures," in which he is right. Some years ago, when I was employed in a picture frame factory, one of the mechanics, a Mr. Jackson, who was working there with me, said he knew a German who used to make picture frames from glass, the process of which he tried to keep a secret, but which was captured from him by Mr. Jackson; and as I think it might be of some amusement and practical utility for some of your numerous readers if you publish the same, I will give you the process:

After having agreed upon the length and width of the frame, get four strips of glass, and after having cleaned them take one of these strips and pour some pure asphaltum, which has been dissolved in turpentine by heat, on the entire length of the strip; and if now you take another of the strips and lay it on the asphaltum, and then press the two strips together with your fingers, you can produce as many "ferns and cacti" as you please by holding the strips between you and the light. After having produced some of these "ferns and cacti," which you wish to retain, apply a knife between one of the ends of the strips and gently pull them apart and lay them aside, so that they may become hard or dry; now proceed with the remaining two strips in the same manner as described, care being taken to match the "ferns or cacti" as near as possible to the one on the two first strips. After having become hard or dry, apply any color or colors that you may fancy on the asphaltum, and let this also dry; then apply some thin composition smoothly with a knife over the colored parts of the strips, this composition being the same that they employ for ornaments for picture frames, etc. When this has also become hard, cut the ends of the strips with a diamond to the proper angle and length, and glue them on four strips of wood which are also of the proper angle and length, and nail them together; the sides of this frame may then be incased with gold or other mouldings.

F. E. FORSTER.

New York, February, 1880.

Fire from Steam Heating Pipes.

To the Editor of the Scientific American:

In respect to fire from steam heating pipes, the letter of Mr. Wm. J. Baldwin may lead your readers into very grave danger unless facts are stated that have come to the knowledge of the officers of this company.

It is alleged that "no one imagines they can light a stick against a boiling kettle, temperature 212°," which is perfectly true; but we have a specimen of wood reduced to charcoal by the heat of boiling water. It constituted a part of an open boiling kier in a bleachery. By long use the inside of this kier had become rough, nails were driven in half their length and cement put on, held by the nails, the heads of course being covered. In less than twelve months the heat carried into the wood by the nails carbonized it.

That charcoal may be inflamed by steam pipe has been proved to us by the fact that one of our members packed a steam pipe across a yard in a wooden box, filling in with fine charcoal as a good non-conductor of heat. Within twelve hours the charcoal was in a state of intense combustion.

A steam pipe was carried through a sill in a new hotel in Woonsocket, R. I., in contact with the wood; in less than twelve months combustion ensued. I have a partially burnt section of this sill, set up with the pipe as it was arranged.

We also have a portion of a factory beam partly burned by contact with steam pipe. Our vice-president found a steam pipe in contact with a floor; the floor was hot at the time it was cut away, and it proved that the beam had been on fire and the fire had gone out for want of oxygen.

We could give several more examples, but these will suffice. We assume that ignition takes place from slow chemical reaction after the wood has become carbonized, and under certain conditions favorable thereto, which may not often occur, but which have yet occurred so often within our knowledge as to make contact of wood with steam heating pipes one of the grave dangers which cannot be tolerated anywhere.

We have within our knowledge numerous examples of the lint of oiled wool, workmen's overalls, and other substances being set on fire by contact with steam heating pipes.

EDWARD ATKINSON,

President Boston Manufacturers' Mutual Fire Insurance Co.

How to Make Tight Tarred Paper Roofs.

Have the lower layer of paper that comes next to the boards without tar or dressing of any kind *(plain paper)*, then over that three layers of tarred paper. When the tarred paper is laid on the boards of the roof it adheres firmly to the boards, and when they come to shrink (as they always do) the paper is torn at the joints between the boards, especially if wide lumber is used the fracture is greater. Plain paper does not adhere to the boards, and they are allowed to shrink or expand without damaging the roof. I have tried it and know that a roof put on in this way will remain tight more than twice as long as when the tarred paper is laid next to the boards, besides it entirely prevents the dripping of tar through the cracks of the roof in hot weather. The extra expense is a mere trifle, not 25 cents each square of 100 feet.

J. E. EMERSON.

Beaver Falls, Pa.

Captive Light.

A little reflection will show that if a means could be found for storing up light, as heat or electricity can be stored, the invention would be of almost infinite application. To discover means of this kind has been the aim of an English chemist, Mr. W. H. Balmain, formerly of University College, London, and latterly manufacturing chemist of St. Helens, Lancashire, for a period extending over forty years, and the results of his researches were protected in a patent No. 4,152, 1877, for "luminous paint." It is known that there are certain earths, such as the sulphides of lime and baryta, and some sorts of sea shell, which, on being exposed to the light for a time, become luminous in the dark, and apparently give out again the light which they have absorbed. Mr. Balmain's idea was to compound a paint of these substances which could be applied to the windows of rooms, the walls of streets, buoys, notices, clock faces, and a thousand other articles which require to be seen in the dark, so as to render them self-luminous. Owing, however, to the health of the inventor breaking down, no practical issues came of his invention until quite recently, when it was taken up in a spirited fashion by Messrs. Ihlee & Horne, of 31 Aldermanbury, London. A pioneer company has been formed to work the patent, and there is now an eager demand for the mysterious illuminant.

The exact nature of the luminous ingredient of the paint is kept a secret, but it is said to be wholly extracted from the common chalk of our cliffs. Probably it is the sulphide of calcium, and is prepared by mixing lime and sulphur in certain proportions. The paint can be made with oil or other transparent liquid, according to the purpose for which it is designed. The physical nature of the storing process appears to be that the waves of light breaking upon the molecules of the sensitive salt start them into vibration, and this vibration continuing long after the motive light is withdrawn, sets up a succession of ether waves which affect the eye as light, much in the same way as the blow of a bell clapper gives rise to waves of sound. A sensitive surface of the paint exposed to daylight, or the more powerful beams of the magnesium wire or electric arc for a sufficient length of time, will continue to emit light for four or five hours after. Of course the "stored" light grows fainter as the time grows longer.

We have made several experiments with a specimen of the luminous paint supplied us by Messrs. Ihlee & Horne on a piece of cardboard. After exposure to the sunlight of a window for a few minutes when taken into a dark place it is seen to glow with a violet luster, which is whiter as the darkness increases, or according as the exposure is lengthened. An amusing optical delusion can be performed with it. A half crown is placed on the painted surface before it is exposed to the light and kept there the whole time; when the latter is taken into the dark room or closet, the coin is withdrawn. Nevertheless its position is distinctly marked by a black disk surrounded by the luminous field of the paint, and it is easy to make any unsuspecting individual mistake the sham shadow for the substance. We call it a sham shadow because it is really the ghost of a shadow, that is, a shadow which exists after the body which occasioned it has disappeared.

Much interest has recently been excited in the product, and many applications of it are proposed. Clocks with dials rendered self-luminous in this way have been some time since introduced by another maker from France; but we understand that a royalty is paid on these to the proprietors of the English patent. The Lords of the Admiralty have been making experiments with it in a darkened room at Whitehall, and have expressed themselves in favor of it for lighting up the compartments of ironclads, or for the powder magazines; and two compartments of H.M.S. Comus have been ordered to be painted with it. For life belts and buoys, it will of course be an acquisition in rendering them visible by night. A lantern capable of enabling a person to read or work in the dark can be made by framing a few square feet of painted surface; and the superintendent of the West India Docks has ordered lanterns for use in their dangerous spirit vaults. The virtues of these lanterns in explosive mines, petroleum stores, and cellars, are too obvious to be dwelt upon. Mr. Towers, who has just supplied the German Navy with his speed indicators, and is now engaged in adapting them also to several English war vessels, notably H.M.S. Northampton, has decided to have the dials of his apparatus illuminated in this way so as to enable seamen on the darkest night to read the index. Mr. Hollingshead, the enterprising manager of the Gayety Theater, is in treaty to secure the sole right to apply the paint in the production of theatrical effects; and it is probable that the process will soon come into conspicuous use as a medium for advertisements.—*Engineering.*

Professor Tyndall's Christmas Holiday Lectures.

On the 8th January Prof. Tyndall, D.C.L., F.R.S., delivered at the Royal Institution, Albemarle street, Piccadilly, the last of this year's Christmas course of "Six Lectures for Boys and Girls on Water and Air." As the lecturer explained at the outset, he confined his attention in what he said of air to its physical properties, and had no intention of entering upon its chemical composition and relations. Torricelli's grand demonstration of the existence and weight of the atmosphere, verified by Perrier's experiments, as suggested by his brother-in-law, Pascal, which proved that the mercury fell in the Torricellian tube as the Puy de Dôme was ascended, was soon followed by his invention of the air pump. It had been claimed for the illustrious Robert Boyle that he greatly improved that instrument, and made with it a great number of important experiments. He saw clearly the condition of the lower strata of the atmosphere, pressed upon as they were by the strata above them. He compared the air particles which sustained this pressure to little corpuscular springs, which cause the air to expand when it is relieved from pressure. Five weeks' continued observation showed him the variation in the height of the barometric column, on which we now base our predictions regarding the weather. He made numerous observations on the influence of atmospheric pressure on the boiling point of liquids.

To Hawkshee is generally ascribed the merit of proving, in 1705, that sound cannot pass through an air pump vacuum; but in a letter from Beaconsfield, dated December, 1659, Boyle described an experiment which proved the same thing. The ticking of his watch he found was extinguished in his exhausted receiver. Boyle imagined, and the notion had even been prolonged to our own time, that the strong adhesion together of two smooth surfaces was caused by the pressure of the atmosphere. That this was an error had been proved by a perfectly conclusive experiment which Prof. Tyndall repeated before his audience, as he had already done in the instance of Boyle's most important ones. Two Whitworth planes were placed *in vacuo*, when it needed as great a force to pull them asunder as that requisite in the open air. Boyle examined the influence of atmospheric friction on a vibrating pendulum. He also made experiments with his air pump on living animals. He put flies, bees, caterpillars, snails, birds, mice, and fish under his receiver, and observed the effect upon them of removing the air. Experiments were also made upon dogs, and the result of his labors was "the lifting of his heart in pious gratitude to the Creator for having made the air so admirably subservient to animal life and enjoyment."

In answer to an attack by the philosopher Hobbes, Boyle wrote his "Defense of the Doctrine touching the Spring and Weight of Air," in which he describes "two new experiments touching the measure of the force of the spring of air compressed and dilated." These two experiments establish with the utmost rigor a law which for generations was ascribed to the philosopher Mariotte. In establishing this law, Boyle omits no precaution necessary to insure exactitude. He worked with a bent tube having a short closed arm and a long open one, compressing the air in the short arm by mercury poured into the long one. In five and twenty different experiments he found that the density of the air was exactly proportional to the pressure exerted upon it, or, as Boyle expressed it, that "the pressures and expansions (volumes) are in the reciprocal proportion." He proved this law true for air at pressures less than that of the atmosphere, as well as at pressures greater than that of the atmosphere. The law of Mariotte should therefore unquestionably be called the law of Boyle. Professor Tyndall having explained the bubbling in the ears felt as we climb a mountain, and shown how it may be stopped by swallowing, remarked further how useful Boyle's poetical expression "the spring of air," is in clearing up such experiments as that of the Cartesian diver, the phenomena of Rupert's drops, and the play of such fountains as depend on the pressure of the atmosphere. The fire engine was also worked by the same agency, and upon it depended the action of the hydraulic ram. In illustration of the power of hydraulic pressure, carbonic acid gas was liquefied before the audience. It was further shown that by it Sir Joseph Whitworth's fluid-compressed steel was not only produced but tested, until at last it withstood a pull of more than a hundred tons on the square inch. Hydraulic pressure, combined with the action of glaciers, had even, as was proved by a working model, produced the "parallel roads" at Glen Roy, in the Highlands, which had so much astonished all who had traveled in the Ben Nevis country.—*London Times.*

AMERICAN INDUSTRIES.—No. 31.

THE MANUFACTURE OF SOLID EMERY WHEELS.

The introduction of solid emery wheels has completely revolutionized some branches of industry, not only in the matter of tools and methods employed, but in the economy of production and in improvements in thr quality and appearance of articles produced. Every household contains articles which bear evidence of having been improved by the application of solid emery wheels. Take, for example, the various kinds of heaters, stoves, and ranges; their plates are nicely beveled and polished, their doors are well fitted and finished. The almost numberless little implements used in and about the house, the builder's hardware used in the construction of the house, all bear evidences of the utility of the solid emery wheel. There is not a mechanic or artisan that is not in some way benefited by the invention of the solid emery wheel; it cheapens tools, affords a means of sharpening them expeditiously, and in many of its applications supplants lathes, planers, files, and cold chisels, and saves an amount of labor that can scarcely be estimated.

Emery is a granular variety of corundum intimately mixed with hematite or with magnetic iron ore. Corundum is composed almost entirely of alumina, and is closely allied to the ruby and the sapphire; in fact, it is nothing more nor less than an impure variety of sapphire, and if the emery of which the tanite emery wheel is composed, or the wheel itself, be examined with a magnifying glass, the particles will be recognized as sapphire, being as richly blue and translucent as the veritable gem.

The main supply of emery is from Asia Minor, near Ephesus, and the fact that Smyrna is the depot for all the emery obtained in the East gave it the name of Smyrna emery A great deal of emery is obtained from Naxos and other islands of the Grecian archipelago.

For many years all of the emery rock of the East was taken to England and there manufactured into grains and flour, and was long known under the equally familiar names of "English" and "Smyrna." It is now largely imported into the United States, and the American mills produce crushed, cleaned, and sifted emery equal to the English.

Emery for the manufacture of emery wheels is crushed by rolling or stamping, sifted, and washed. It is in the form of grains, the coarsest being about like split peas, the finest like flour. The several grades of emery are made up into emery wheels by cementing the grains together by some cohesive substance, and pressing the mixture into moulds of suitable form. Shellac and glue were among the first cementitious substances tried, but they were easily affected by heat; the wheels were therefore defective. Various gums and resins have been tried; soluble silicates have been used, and concrete composed of emery and cement has formed the *basis* of another class of wheels. The important requisite of a good wheel is to combine its elements so that the emery will be thoroughly cemented together with the smallest possible proportion of cohesive substance. In addition to this it must be of uniform density and free from hard or soft spots. It must remain unaffected by the heat generated by its use, and should be free from offensive odors. It should cut freely and rapidly, and not fill up with metallic particles. It should be durable, and above all, it should have sufficient strength to admit of a high velocity without danger of bursting. It is claimed by the Tanite Company that the tanite emery wheel fulfills all these requirements.

Our large front page engraving contains exterior and interior views of the Tanite Company's works at Stroudsburg, Pa.

The tanite solid emery wheels are composed of the purest and best grades of emery and tanite. A portion of the process of manufacture is kept from the public, but enough is revealed to enable us to give the reader a general idea of the mode of manufacture.

Tanite is the invention of T. Dunkin Paret, who has served as President of the Tanite Company for eleven years. The company's motto, "*Ex inutili utilitas*," indicates the utilization of a waste substance.

The crude material from which tanite is made is waste leather scraps, or skivings, as they are called in the trade; the product is a hard, fine-grained, jet-black substance, which may be moulded under a high heat and pressure, and which is capable of receiving a polish equal to that of the best Whitby jet. It was invented as a substitute for vulcanite, and has been used in the manufacture of combs, buttons, jewelry, checkers, dominoes, and a large variety of fancy articles. Its application to the manufacture of solid emery wheels was suggested by Mr. Abijah Wallace, of New York city, an experienced worker in horn, shell, and rubber. Mr. Wallace was, for many years, superintendent for the Tanite Company, and is still a director and stockholder. He recognized the adaptability of tanite to the manufacture of emery wheels, and from that time to this, tanite emery wheels have been slowly improved through a period of thirteen years, until they are now considered as nearly perfect as it is possible to make them.

The factory of the Tanite Company consists of several buildings, spread over considerable ground, and forming the picturesque group shown in the central view in the engraving. The works are situated about two and a half miles from Stroudsburg, Pa., in the town of Monroe, in the middle of a fifty acre farm, through which flows a beautiful stream, the Pocono Creek, furnishing the works with power.

The machinery of the factory is driven by a 42-inch Jonval turbine under a 23½ foot head. In addition to the water power, the works are provided with a steam engine capable of running all of the machinery. A great deal of space is devoted to the manufacture of a large variety of emery grinding machines. The Tanite Company were the first to combine the manufacture of grinding machines and emery wheels, and have for years been advocating the use of solid emery wheels instead of grindstones and files.

They are noted for their enterprise and energy in adapting their machinery and wheels to the wants of different trades and manufactures, and, notwithstanding the fact that their wheels command a higher price in the market than other goods of the same class, their sales are very large, and the reputation of their goods is as excellent as it is world-wide.

The manufacture of the emery wheel is very simple. The first operation being that of mixing the granulated emery with the tanite. This is done in one of the apartments shown in the upper part of the engraving. The mass of emery and tanite is transferred from this room to the press room, where it is placed in moulds and subjected to strong pressure in the hydraulic presses, while it is at the same time heated by steam passing through the jackets of the moulds.

The last operation in the manufacture of the solid emery wheel is that of turning them perfectly true, by means of diamond turning tools in lathes especially adapted to the purpose, and provided with a hood communicating with an exhaust fan for removing the emery dust. After turning all that remains to be done is to apply the labels and pack the wheels preparatory to shipping.

The Tanite Company have offices and warerooms in Liverpool and London, besides carrying a stock of goods in Boston, Chicago, St. Louis, San Francisco, and in many other of the principal cities and towns in the United States. In Canada and Australia these goods have long been well known.

We are informed that after canvassing the matter thoroughly, the Tanite Company have decided to meet a general demand, by introducing at an early day a low priced wheel, at the same time keeping up the quality of their standard goods.

Liability from Sparks.

Some three months since the *Lumberman*, under the above caption, called the attention of its readers to the fact that improperly guarded smoke stacks were an element of danger not only to the surrounding property, but, as well, to the bank account of their proprietors. We at that time, says the above paper, cited the case of McLaren *versus* the Canadian Central Railway as an instance in point. The mills of the plaintiff at Carlton Place, Ont., together with the mill yards, were destroyed by fire caused by sparks from a locomotive belonging to defendants, which, in passing the yards, emitted sparks which were seen to fall and ignite the lumber, and damages to the amount of $140,000 resulted. Upon suit being instituted in the Court of Queen's Bench, a jury rendered a verdict for $212,000, which being largely in excess of the damages claimed by Mr. McLaren, a new trial was granted, which, on change of venue asked by the railway company, has just taken place at Toronto, and damages awarded to the plaintiff of $100,000. The telegraph announcement of the verdict also stated that the case would be appealed, but it was not stated whether by Mr. McLaren upon the ground of insufficiency of the amount, or by the railroad company. Be this as it may, it is another strong assertion of the law that no man has a right to improperly expose his neighbor's property to destruction. The defense of the railroad was mainly upon the point that ordinary care had been taken to provide sufficient spark catchers to the engine, and that they had done all that they could reasonably be expected to do to avert such calamities. The decision indorses the old-time notion that it is not enough to hope that our neighbor will not be injured by us; we must be sure of the fact, and will be liable for all damage resulting from our neglect. Mill men would, in the light of this decision, do well to so arrange their stacks and chimneys that they will not be open to the liability resulting from damage to their own or their neighbors' property. We append the questions submitted by the learned judge for the consideration of the jury, from which our readers will gather an idea of the points upon which the case hinged. We also append the following extract from the charge of Justice Williams, at Buckingham, England, in a case against the London and Northwestern railroad involving the same points, in which the learned judge said:

"It remains to consider what is to be regarded as negligence on the part of the company for the consequences of which they are to be held responsible. The company, in the construction of their engines, are not only bound to employ due care and all due skill for the prevention of mischief accruing to the property of others by the emission of sparks or from any other cause, but they are bound to avail themselves of all the discoveries which science has put within their reach for that purpose, provided they are such as under the circumstances it is reasonable to require the company to adopt."

The questions submitted to the jury in the McLaren case were as follows:

1. How did the fire occur? Was it from sparks or cinders from the locomotive, or some other cause?

2. If you find the fire was caused by this locomotive, did it come from the smoke stack or ash pan?

3. If you find that it came from the smoke stack, was it from any imperfection in the construction of the stack, or from the manner in which it was managed by those in charge of the train?

4. If you find it was from any imperfection of construction, state what the imperfection was.

5. Was the netting too large, or was the bonnet improperly fastened?

6. If you find it was from improper or careless management of the smoke stack, what was the act done imputing to the defendant such improper carelessness?

7. If you find the ash pan or damper were not properly managed, in what respect were they improperly managed?

8. Was the mesh on the bonnet of engine No. 5 composed of a larger size than that used by the Great Western or Northern railway?

9. Were the defendants guilty of neglect in using such a mesh?

10. Was the plaintiff guilty of contributory negligence in piling his lumber so near the track, leaving the shavings about and not having sufficient appliances to extinguish fires?

The jury then retired at four o'clock, and returned at twenty minutes to seven o'clock with a verdict for plaintiff —damages $100,000.

Tea Taster's Occupation.

Dr. C. L. Dana, in an article in the *Medical Record* on tea tasting by brokers and dealers in teas, maintains that it is a healthful occupation, which is not in accordance with the conceived opinion of other writers on the subject. In support of his assertion Dr. Dana reports cases of living men far advanced in life who have followed the business of tea tasting for periods ranging from thirty to forty years without injury to their health. But whether the writer's conclusions are correct or otherwise, the life of a tea taster is a curious one, and the process of examining and deciding upon the qualities of the article is one not generally known.

There are, says Dr Dana, probably more than a hundred firms engaged in tea tasting in this city. In all of their offices there are large tables with round, revolving tops. A circle of teacups is placed along the edge of these. The tea taster sits down before the display of crockery, and tastes one cup after another, moving the table-top around. In the center of the table is a pair of scales with a silver half dime in one of the balances. One or two large kettles are kept constantly with boiling water in them. When a sample of tea is to be tasted, as much is weighed out as will balance the half dime. This is put in a teacup and the boiling water poured on. The tea taster then stirs up the leaves, lifts them on his spoon, and inhales the aroma. At the same time he generally takes a sip of the infusion, holds it in his mouth for a short time, and then spits it out. Enormous brass cuspadores, holding two or three gallons, receive the tea thus tasted and the contents of the cups that have been examined. On some occasions, when a large amount of tea of a certain kind is to be bought, many samples of this are brought in from different houses. The buyers and sellers sit around the revolving table with the samples made into infusions in the cups before them. These are tasted all around, the "body," fineness, "toastiness," etc., are learnedly discussed, and the poorer specimens discarded. Then those that are left are tasted again and the number further reduced. So it goes on until the article which unites the desired quality and price is obtained.

The skill displayed at these "drawings" is quite remarkable. A tea taster will detect not only the quality of a tea as regards age, strength, flavor, fineness, etc., but he can tell in which of the numerous districts in China the tea was grown. The facts regarding the different samples are sometimes put on the bottom of the cups, where they cannot be seen. The cups are then mixed up, and the infusions tasted again and sorted out simply by their flavors.

A great deal of tea may be tasted before these tea drawings are finished. It is hard to tell the amount that a tea taster takes during a day, for it varies a great deal with the activity of business. Few of the gentlemen whom I asked could give any idea. Sometimes, however, as many as four or five hundred cups are tasted in the day. It is quite the custom to have to be tasting tea steadily for the most of the day, or for hours at a time. Probably an average of two hundred cups a day throughout the year is a low estimate. The poorer kinds of tea are often not sipped at all. But the sense of smell is depended on. Of the better qualities of tea, some is swallowed, and some spit out. Indeed, whenever the tea is taken into the mouth a little of it is swallowed. The tea gets into the system, therefore, in three ways: by inhalation, by absorption through the oral mucous membrane, and by the stomach. More tea is simply taken into the mouth without swallowing than is inhaled alone; but all the tea is inhaled, even if it is tasted also. It is only a small proportion, amounting to not more than two or three cups a day, that is swallowed. A silver five cent piece weighs 1·18 grms. (gr. xviii.) Estimating that an average of two hundred cups of tea are tasted per day, about one-half of a pound would represent the whole amount used.

Japan tea has of late years become by far the most popular variety, and more of it is imported than of all other kinds together. Green tea, on the other hand, is much less extensively used than formerly.

A SOUND and liberal education is the surest pathway to success in all pursuits. Statistics show that the educated man will, on the average, be as far advanced in his career at thirty-five years of age as the uneducated at forty-five or even fifty. Not one out of every ten of uneducated men achieves success.—*J. M. Gregory, Champaign, Ill.*

THE BINARY ABSORPTION SYSTEM OF REFRIGERATION.

A new competitor in the field of artificial refrigeration appears in the binary absorption system invented by Messrs. C. M. Tessié du Motay and Leonard F. Beckwith on the one hand, and Messrs. C. M. Tessié du Motay and Aug. J. Rossi on the other. The accompanying illustration of the apparatus will remind our readers of the Pictet system, an engraving of which appeared in our issue of December 1, 1877.

The aim of the inventors has been to substitute the chemical affinity of two or more volatile substances for each other in place of compression, to effect the liquefaction of the refrigerating agent; and to discover a compound which should possess the refrigerating power of anhydrous sulphurous acid without its objectionable qualities.

Such a liquid they claim to have found in ethylo-sulphurous dioxide, a bland compound of the appearance of water, liquid at ordinary temperatures, non-inflammable, and without corrosive action upon metals even when mixed with water. Under the gas pump the liquid is volatilized, with a great reduction of temperature, the refrigerator being surrounded by a non-congealable liquid, which is used as a freezing mixture.

The least volatile constituent of the ethylo-sulphurous dioxide is liquefied at a few pounds above atmospheric pressure, and then by natural affinity the more volatile element is absorbed. The heat of liquefaction, which is comparatively low, is carried off by water. A marked economy is, therefore, claimed for this process, compared with the use of sulphurous acid alone. When the machine is working the pressure ranges from 18 to 15 pounds, and the water for cooling the combined liquid runs from 1 to 2 gallons a minute for each ton of ice produced in 24 hours. When the machine is at rest the pressure is from 0 to 2 pounds; and when the water for cooling is turned off the pressure is not likely to rise to a dangerous point.

Working as it does at low pressure the new machine is easily kept from leaking without the expensive cocks required in machines working at high pressures. As the liquid has no action on metals, is not explosive, and requires no greasing of the gas pump for lubrication, it is claimed that the more serious difficulties experienced in other processes are practically obviated. There is the further advantage that the liquid is safe to handle and can be transported in ordinary vessels of glass, wood, or sheet iron.

These advantages presented by the binary system are certified by Messrs. C. H. Delamater & Co. as the result of experimental tests made at their establishment.

The ice is formed in large galvanized cans set vertically in a tank containing the non-congealing brine, which is circulated back and forth through the refrigerator of the machine. The cost of fuel and labor in running a 50 ton machine is set down at 78 cents for each ton of ice produced.

The machines are intended for refrigerating breweries, warehouses, dairies, ships' holds, etc., and for cooling hospitals and other buildings, as well as for making ice.

The business development of the invention has been undertaken by the New York Ice Machine Co., whose office is in room 54, Coal and Iron Exchange, 21 Cortlandt street, New York.

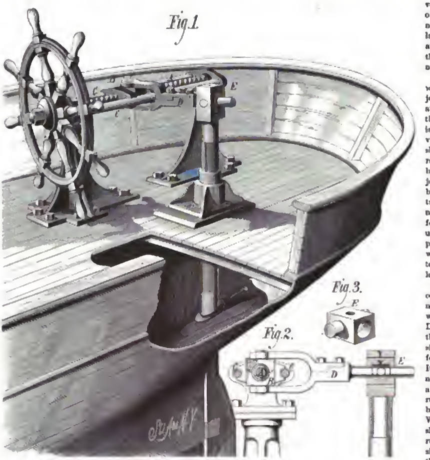
NEW STEERING APPARATUS.

The attention of inventors has been drawn to the need of a reliable steering gear by the alarming frequency of marine disasters attributable to the breakage of steering apparatus, and we are able to present our readers with an engraving of a device that seems capable of fulfilling the requirements, which are really more arbitrary than is generally supposed.

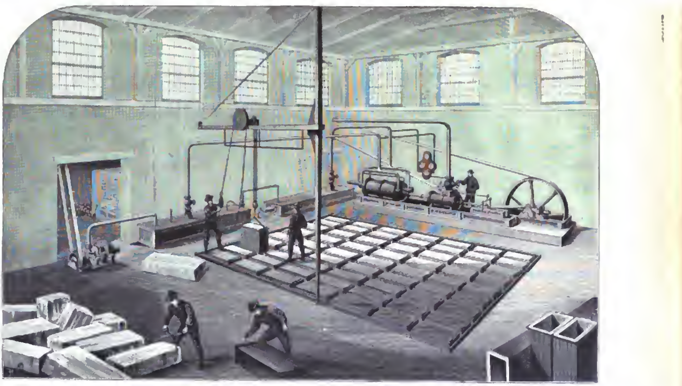
This steering apparatus is the invention of Mr. Pablo Perez Seoane, of Havana, Cuba, Inspecting Engineer of the Spanish Navy. The large perspective view shows the application of the mechanism, while the smaller views represent details not shown in the larger view.

The screw, A, which is provided with a tiller wheel at one end, is journaled in two standards arranged at the side of and equidistant from the rudder post. A traveling nut is placed on the screw, A, and provided with grooved arms capable of sliding on guides, C, arranged parallel to the screw, A, and supported by the posts in which the screw is journaled. The nut is embraced by a box, B, which is split longitudinally and provided with trunnions, which are journaled in the forked end of the lever, D. The upper end of the rudder post is provided with a strong socket, in which is pivoted a box, E, adapted to receive the cylindrical end of the lever, D.

As the tiller wheel is turned in one direction or the other the nut on the screw is moved, carrying with it the forked end of the lever, D, which moves the rudder. As the rudder post turns the lever, D, slides in the box, E, to compensate for the angular motion of the nut. It often happens that the bearings of the rudder post are not perfect, and that every wave that strikes the rudder moves it laterally in its bearings besides tending to turn it. With this arrangement a sudden shock on the rudder post when the rudder is struck by a heavy sea, simply exerts its force in moving the rudder head along the lever, D, and has no tendency to bend or twist any part of the mechanism, nor to put any undue labor on the man at the wheel. It will be seen that any vertical motion of the rudder is provided for in the pivoted connections of the lever, D, with the head of the rudder post and with the traveling nut, so that if the rudder should strike bottom, as in case of running ashore, the steering gear would receive no injury. This device is shown in the engraving as adapted to hand steering, but it may be worked with steam with the same advantages.



SEOANE'S STEERING APPARATUS.



THE NEW ABSORPTION PROCESS ICE MACHINE.

MARINE AND LAND HERMIT CRABS.

BY A. W. ROBERTS

The marine hermit crabs, which the naturalists define as decapods (ten legged) crustacea of the genus *Eupagurus*, ought not be treated with contempt. Their high-sounding name should entitle them to some respect. Their history when told will afford material for observation and reflection.

We will begin with the little hermit crab, Figs. 1 and 2 (*Eupagurus longecarpus*), or long armed hermit crab, common on all parts of our coast, which is considered to be one of the most amusing and intelligent inhabitants that can be kept in the marine aquarium. It is very hardy and will live on either animal or vegetable substances, and is at the same time an excellent scavenger. The favorite dwelling of this crab is an empty shell of the little whelk (*Buccinum undatum*), one of the commonest shells on our coast. When placed in an aquarium these crabs display great activity, and are always on the go, climbing up the rocks and algæ, or scuttling along the bottom with surprising agility.

All the marine hermits have the credit or discredit of being an exceedingly irritable and crabbed family of crustaceans, for whenever two hermits meet they are sure to engage in what appears to be a fierce encounter, until the weaker one abandons the contest and skedaddles in most ludicrous haste, often rolling over and over across the tank. Yet in all these encounters I have witnessed I have never seen as much as a claw lost, and am of the opinion that it is their way of having a good time.

It does not inconvenience a hermit crab in the least to lose or have a claw fractured; all he does or cares is to amputate it down to the next joint, at the same time making a hearty meal of the fragments of flesh that are removed during the operation. In a few weeks a new claw is developed, and he is as well off as ever. All crustaceans have this power of renewing lost members.

The claws, head, and shoulders of the hermit crab are encased in armor as hard as that of the lobster, but the hinder part of the body is soft and defenseless, hence the necessity of protecting it from the attacks of other fish by inserting the caudal extremities into the interior of the empty shells of some sea snail, winkle, or other univalve. By means of the appendages, or hook-like processes at the end of the tail (Fig. 2), the hermit crab is enabled to clasp the upper inside portion of the columella of a shell with wonderful tenacity, and rather than let go his hold will suffer decapitation. Another interesting fact in their organization is that the two sides of the body are unequal in size, thus enabling them to fit compactly in the chamber of the shell, their two larger claws are also unequal, and in some varieties flat on the inner sides, so that when the crab withdraws into his shell they fit closely together, securely closing the entrance against attack from outsiders.

As the hermit increases in size he is reminded by the uncomfortable tightness of his quarters that it is well to be on the look out for a more roomy home. This house hunting and removal is the most trying period in the life of a hermit, and brings out all his wonderful instinct. After carefully examining the empty shells that are in the aquarium he at last selects one for his new home. This he seems to lift up in his claws as if to try its weight, or to be certain there are no holes in it whereby the insidious neris worm might perform a rear movement on him unawares. Being satisfied as to lightness and exterior fitness, he proceeds with great gravity to examine the interior by inserting one of his long claws, very cautiously at first, as if to ascertain if anybody is inside; now twirls the shell round to make sure that it will prove a good fit, and that the walls of the chamber are smooth and free from sand, for the reception of his caudal extremity. Just at this critical moment a big hulking hermit comes along and butts him over, new house and all. For half an hour our house-hunting friend remains motionless inside his shell, with his front door claws closed tight, wondering what it was that went off. Presently out peep his long stalked eyes through a crevice of his claws, just to find out where he is; then he cautiously protrudes his legs and moves off in search of another shell. Coming across the previous one that had so pleased him, he gives it a wide berth, as a dwelling to be avoided by all wise house hunters. Having selected another shell, now comes the greatest trial of all in the life of a hermit crab, which is to get out of the old home and into the new without parting with his soft extremities. For who can tell but that some fish, who has been waiting and watching for many a day for just such a dainty meal of soft crab, is not at this very moment lying in wait for him to catch him just at the moment when he has left the old shell. To defeat such an attempt our little marine friend proceeds to place the entrance of the two shells near together; with most ludicrous haste he whisks out of his old house and backs into his new. For a minute he remains motionless, as if asking the question, "Am I all here?"

Should you wish to have a hermit leave his shell and take up his abode in one of your own selecting, the safest way to accomplish it is to place him on the disk of some large anemone. As soon as the hermit finds himself being engulfed in the thousand tentacles of the anemone he instantly realizes that his only chance for escape is to slide out of his shell and drop down. Another method is to place him in impure water, or water that is deficient in oxygen; but as soon as he leaves his shell he must be placed in good water and supplied with his new shell. The hermit crab is the first creature in an aquarium to show signs of distress when the lower strata of water becomes charged with deleterious gases. He will abandon his shell and wander about without it, a most forlorn looking object.

During the months of July and August I have collected large quantities of hermit crabs at Gravesend Bay, Long Island, in the following manner: When the tide has fallen off the sand flats that skirt the Coney Island shore of the bay, I dig a semicircular trench, one foot deep, two feet wide,

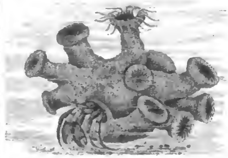


Fig. 3.—CORAL HERMIT CRAB.

and about twelve feet long. This trench is situated half way between high and low water. When the tide floods, up come the little hermits with it, to once more be in safety on the flats away from the dogfish and skate, which have a great weakness for these fat little hermits, swallowing them shells and all. When the advancing hundreds of little hermits reach the trench, into it they tumble, nor can they climb up the steep sides of shifting sand.

The next most common hermit crab is the short armed hermit crab (*Eupagurus pollicaris*). This species attains a large size, and inhabits the largest mollusks on our coast, viz., the pyrulas and naticas. I can only recommend this crab for use in public aquaria, it being so strong and active that when placed in a self-supporting aquarium, it soon

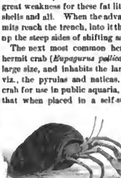


Fig. 1.—Little Hermit in Shell.

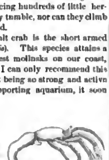


Fig. 2.—Little Hermit Out of Shell.

breaks up all artistic groupings of rock work and algæ. On different parts of our coast this crab is called by the fishermen "Jack in the Box," "Thief," and "Stone Lobster," and is believed by some fishermen to leave its shell and turn into a lobster. When collecting this crab many specimens will be taken deficient of one eye and even both; this is the work of the black fish and bergalls, which are partial to a diet of crabs' eyes. This fact was clearly proven at the New York Aquarium. When feeding the fish in the "shark tank," small particles of food were left on the floor of the tank, thereby endangering the health of the water. To overcome this difficulty I placed in the tank a large number of short armed hermits and also blue crabs, to act as scavengers; no sooner were they in the water than the black fish began feasting on the eyes of these crabs. Most of the hermits managed to save their eyes by withdrawing into their shells during the day, and only venturing out at night to feed.

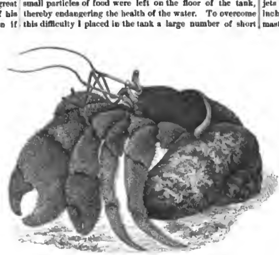


Fig. 4.—DIOGENES LAND HERMIT CRAB.

Fig. 3 is *Eupagurus pubescens*, incrusted with *Epizoanthus Americanus*, one of our native corals. The specimen from which the enlarged drawing was made I dredged at Wood's Hole, Mass., and is about one inch in length by one-half inch in breadth. I generally dredged it in from thirty to forty feet of water.

I have obtained specimens of this crab with only a single polyp cell of the coral attached to their shells, clearly proving the fact that this incrustation of living coral at first starts with a single coral polyp. In course of time this coral growth so nearly closes up the entrance to the shell that the crab inside is unable to make his exit when he wishes to occupy a larger shell, which always occurs when the "shedding" period commences, and in consequence drags out a miserable existence, finally perishing in a tomb of living coral.

This doubly interesting crab lives well in a self-supporting aquarium, but requires to be fed by hand, as it is not much of a forager with the heavy load of coral. In the cut two of the coral polyps are shown fully expanded.

Fig. 4 illustrates one of our most beautiful of land hermit crabs (*Cenobita Diogenes*), native of Florida. For many months past a large number of these interesting and beautifully colored crabs have been on exhibition at the New York Aquarium, and have attracted much attention. This crab does not seem to prefer any particular shell, so long as it obtains a secure covering for its soft and unprotected parts; turbos and cones are all the same to it.

The first lot of these crabs that came under my charge I placed in a tank, from the inner side of which was suspended a chain used for the purpose of pulling out a plug from the bottom of the tank. When feeding them next morning I was surprised to find a number of them missing, nor did I for a long time suspect that they had climbed up the small chain and escaped from the tank. After this discovery I often suspended pieces of twine inside of the tank, up which they would climb at night and treat themselves to a walk around the floor.

These crabs are nocturnal in their habits, and during the day they withdraw into their shells, huddling in one corner of the tank. I fed them on apple, mashed potatoes, and oyster crackers.

Fire Engine for H. M. S. Sultan.

On the 13th January, the concluding trial of the steam pumping engine and steam fire engine constructed by Messrs. Shand, Mason & Co., for H. M. S. Sultan, took place on board that ship at Portsmouth Dockyard. The order for the pumping engine was given in consequence of the satisfactory results attending one designed by the same makers for H. M. S. Hercules, which has been in use in that ship since March, 1878. In addition to the pumping engine a powerful steam fire engine, also by Shand, Mason & Co., has been fixed on board the Sultan, both engines being connected with the same boiler. This latter is of the makers' well known "inclined water tube" type, so extensively used with their steam fire engines, the pumping and fire engine being on the plan of their equilibrium engine. The pumping engine consists of three steam cylinders, each 10 inches in diameter, placed vertically and connected direct to three bucket and plunger pumps, the buckets being $17\frac{1}{4}$ inches with a stroke of 18 inches. The construction of the steam fire engine is similar, but is placed horizontally, the three steam cylinders being $8\frac{1}{2}$ inches in diameter, and the buckets of the plunger pumps $8\frac{3}{4}$ inches, with a stroke of 8 inches. The boiler and engines are placed sufficiently high in the ship so as to be worked even with a large quantity of water in the hold, special attention having been paid to the valves of the pumping engine, so as to draw water without fall from the lowest part of the ship. The preliminary trial took place on the 6th instant, when the following four jets were used at the same time: one $1\frac{1}{8}$ inch, one 1 1-16 inch, and two each 1 inch, when a height, as measured by the mast, of 170 feet was reached. It was then found that the means for supplying the pumping engine with a sufficient quantity of water was inadequate, and this test was adjourned for the purpose of making arrangements to admit a sufficient quantity of water into the hold. On the 7th instant a test of the fire engine was made in the presence of Admiral Foley, Superintendent of Portsmouth Dockyard, when with one jet, $1\frac{1}{8}$ inch in diameter, the water was thrown considerably above the top of the mast, a height of 200 feet. The following four jets were used simultaneously, one each $1\frac{1}{4}$ inch, $1\frac{1}{8}$ inch, 1 1-16 inch, and 1 inch, delivering 1,120 gallons per minute under a water pressure of 100 lb. on the square inch. The tests on the 13th instant and that on the 6th were conducted under the superintendence of Mr. Newman, Chief Engineer, Portsmouth Dockyard, Mr. Marcom, his assistant, Mr. Icely, Inspector of Machinery, Captain Wells, Superintendent of the Steam Reserve, Mr. Shearman, Chief Engineer of H. M. S. Sultan, and other gentlemen, all of whom were perfectly satisfied with the result, Mr. Shand being present on behalf of the contractors. The experiments occupied about two hours, the result of half an hour's continuous working with the pumping engine, with an average of 84·6 revolutions per minute, delivering 720 tons per hour from a depth of 21 feet 6 inches below the pump valves, and delivering under a pressure of from 20 lb. to 25 lb. on the square inch, this rate of delivery being practical, not theoretical, as the quantity was tested from the influx of water through valves from the side of the ship into a measured area of the hold.—*Engineering*.

MR. GEORGE BERWICK has taken a series of photographs of the moon on very sensitive plates—the bromo-gelatine. One of the plates shows three well defined rings around the moon. Whether the rings are due to cosmical, atmospheric, chemical, or optical causes is not yet determined.

The Manufacture of Porpoise Oil.

BY CAPT. CALEB COOK, OF PROVINCETOWN, MASS.

About the year 1816, sailors and fishermen having caught a porpoise on their voyage, would sometimes extract the oil from the jaw bone and give it to carpenters and those who used oil stones for sharpening their tools. Finding in this way that it did not gum or glue, suggested the idea that it was just what was wanted for a nice lubricator. It was noticed that the weather at zero would not congeal it, neither would it corrode on brass.

Watchmakers were then using olive oil as the only fitting oil for watches; but by experimenting with the porpoise jaw oil they found it superior to the olive or any other oil, consequently the sailors and fishermen found a ready market for all they were able to obtain.

This state of things continued until the year 1829, when a shoal of blackfish, about forty in number, was taken at Provincetown, Mass., being the first for many years. Solomon Cook, of that town, took from the jaws of those blackfish a few gallons of oil, and sent it to Ezra Kelley, of New Bedford, Mass., a skillful watchmaker, to be tested for watch oil. Mr. Kelley soon found that this oil was superior to the porpoise oil, as it had more substance and less chill. He contracted with Solomon Cook to supply him from year to year until 1840, when Solomon Cook died, and his oldest son supplied Mr. Kelley until the demand was so great that the jaws of the blackfish were not sufficient to supply the market.

Porpoise jaw oil can be refined a little by exposure to the cold at zero, and in that state, with the atmosphere at zero, it is strained through a cotton flannel strainer made in the shape of a cone, but when filtered through paper it is so limpid that it has no lubricating properties whatever, and becomes useless. This oil is called porpoise jaw oil, but is taken from the blackfish, belonging in the family of whales, by a method known only by myself. It is warranted not to congeal with cold at zero, though it will thicken and turn a little milky in appearance. It is warranted not to corrode on brass or rust on steel, and it will not glue on the finest watch. Ezra Kelley, of New Bedford, Mass., has made it a business for many years to put it up for watch use, and has led in the market, while B. H. Tisdale, of Newport, R. I., and I. M. Bachelder, of Boston, are getting quite popular in the European market.

Caleb Cook, youngest son of Solomon, from scientific experiments, did discover, about the year 1842, that the melon oil of the blackfish was far superior to the jaw oil in every respect—so much so that Mr. Kelley, who had about this time become very popular in preparing this oil for the trade, would not buy it until he was told what it was produced from; and from that time to the present, 1876, Caleb Cook's blackfish melon (watch) oil has been refined by Kelley, of New Bedford, Bachelder, of Boston, Tisdale, of Newport, and many others on a smaller scale, for the world's use. Since the year 1842, Caleb Cook, of Provincetown, Mass., claims to be the only person who understands the art of producing this oil free from all glutinous matter and fit for use. This, he says, is done by a process known only by himself—not by mixing other oils or liquids with it, but by extracting all the acid and gluten from it, and leaving the oil pure for the finest and most delicate machinery. This, he says, cannot be done by the chilling and straining process; for when it becomes perfectly transparent at zero, the lubricating properties are all gone, the oil runs off the pivots, spreads on the plates, dries up, the pivots cut, turn red, and the oil is worse than worthless, for the valuable timekeeper is no longer what it was once for the want of oil with more substance and lubricating properties.

Porpoise jaw oil and blackfish melon oil are worth from $5 to $15 per gallon, according to supply. These oils are sold under the above trade names, and also under the names "watch oil" and "clock oil." They are used largely by manufacturers of firearms, watches, and philosophical apparatus. Smith & Wesson, of Springfield, Mass., the Ethan Allen factory, at Worcester, Rye & Johnson, of Worcester, the Howard Watch Company, the Elgin Watch Company, the Waltham Watch Company, and the clock factories in Connecticut, use them constantly. The philosophical instrument makers use them for air pumps, as they keep the leather always soft and pliable. Telegraph instrument makers use them when they can get them. They are used in government lighthouses for the clocks of revolving lights. The color of the oils is very light, and can be made very white by placing in the window, where they will bleach in a short time. One drop of water in one pint of the oil will injure it very much.

It may be interesting to know how those fish or whales are taken. They make their appearance about the shores of Cape Cod and Barnstable Bay from early in the summer until early in winter; and when it becomes known that a shoal of blackfish is in the bay, the boats are manned and proceed at once to get in their rear; and, as the fish are at the surface of the water the most of the time, it is easy to tell how to manage to keep them between the boats and the shore. While in this position the men in the boats will make all the noise with their oars they can, and that will cause them to go in the opposite direction from the boats and toward the shore; and when the fish find that they are in shoal water, by seeing the sandy bottom, they become alarmed, and go with all their might till they run fast aground on the sand. The boats then row in their midst; the men with lance in hand jump out of their boats into the water, and butcher them as a butcher would a hog, and it becomes one of the most exciting occasions that it is possible to imagine, for the water flies in every direction, and the blood flows freely until death puts an end to the great tragedy. When the water ebbs and leaves them dry, their blubber is taken off, cut in slices, and the oil tried out. About thirty gallons upon an average is what one fish will make, and the melons will average about six quarts. The melons are taken from the top of the head, reaching from the spout hole to the end of the nose, and from the top of the head down to the upper jaw. When taken off in one piece, they represent a half watermelon, weighing about twenty-five pounds. When the knife is put into the center of this melon, the oil runs more freely than the water does from a very nice watermelon—hence the name melon oil.

About the same time that the blackfish made their appearance in our waters, another of the whale species made its appearance also, called by the fishermen "cowfish" and by the historian "grampus." These whales are very much in the shape of the blackfish, only smaller, not so fat, and not so dark colored. The oil from the melon of this fish is thought to be superior to anything yet found in the blackfish or the porpoise. It is of a very yellow color, and when reduced by the chilling and straining process, it appears to have all the body and lubricating properties that are wanted for the very best watch oil; but as it will take one year to determine it by practical experiments, it is thought best to keep it out of the market for the present.

This fish has made its appearance in our waters but three or four times in the last forty years, or about once in ten years. The method of taking it is the same as for the blackfish.

Cape of Good Hope Whales.

The villages between Simon's Bay and Wynberg have fences made of various bones of whales. A whale fishery was formerly carried on here, but no longer pays. An extremely interesting and very rare whale is occasionally procured at the Cape. It is a ziphioid, *Mesoplodon layardii*. The ziphioids are a group of the toothed whales, and allied to the sperm whale. They have the bones of the face and upper jaw drawn out and compressed into a long beak-like snout, which is composed of solid bone, hard and compact like ivory.

The upper jaw is devoid of teeth, having lost them in the process of evolution, and the lower jaw, which is lengthened and pointed to correspond with the upper, retains but a single pair of teeth. In the species in question, these two teeth in the adult animal become lengthened by continuous growth of the fangs into long curved tusks. These arch over the upper jaw or beak, and crossing one another above it at their tips, form a ring around it and lock the lower jaw, so that the animal can only open its mouth for a very small distance indeed.

The tusks are seen always to be worn away in front by the grating of the confined upper jaw against them. How the animal manages to feed itself under these conditions is a mystery. It is remarkable that the main mass of each tusk is made up of what appears as an abnormal growth of the fang. The actual conical tooth, that is, the original small cap of dentine of the tooth of the young animal, which corresponds to the part of the tooth showing above the gum in other whales, does not increase at all in size, but is carried up by the growth of the fangs, and remains at the tips of the tusks as a sort of wart-like rudimentary excrescence.

Specimens of *Mesoplodon layardii* are excessively rare, and I sought diligently for such during the whole of my stay at the Cape, and was rewarded by procuring parts of two skulls.

One of these, a skull without the lower jaw, I found near Mr. McKellar's at Cape Point. The skull was exposed on the beach, being stuck up with its beak thrust into the sand to be used as a rifle target.

The animal, as Mr. McKellar told me, had come on shore about eight years before. It yielded oil of a very superior quality, which sold for more than twice the price of ordinary whale oil.

It was about 10 feet in length, and was, as far as he remembered, colored black on the back and white on the belly, with a conspicuous line of demarkation of the colors on the side. The beast had the usual tusks.

The other specimen consisted of the snout and lower jaw, with the tusks, of another example of the species. It was given me by Mr. A. M. Black, of Simon's Town. The animal came on shore at Walwick Bay in 1869. It yielded 80 gallons of oil, and was from 16 to 18 feet in length. It is remarkable that these whales seem never to be met with or caught at sea. They always are procured by their running on shore. The ziphioids are especially interesting, because many species were abundant in tertiary times, and their beaks being so dense in structure as to be readily preserved as fossils, are common in such deposits as the Red Crag of Suffolk. I had the good luck to procure another ziphioid at the Falkland Islands during the voyage, near Port Darwin.—*H. N. Moseley's Challenger Notes.*

In the Clutch of an Octopus.

Our readers are familiar with the appearance of the octopus from the illustrations of it which have appeared in these columns, and therefore they will understand the manner in which a diver in Australia was attacked by one of these monsters, as graphically described by the victim in the Melbourne *Argus*: "Having thrust my arm into a hole, I found that it was held by something; the action of the water was stirring up the clay, and therefore I could not see distinctly for a few minutes; but when it did clear away I saw to my horror the arm of a large octopus entwined around mine like a boa-constrictor. Just then he fixed some of his suckers on the back of my hand, and the pain was intense. I felt as if my hand was being pulled to pieces, and the more I tried to take it away the greater the pain became; and from past experience I knew this method would be useless. I had the greatest difficulty in keeping my feet down, as the air rushed along the interior of my dress and inflated it; and if my feet had got uppermost I should soon have become insensible; and if I had given the signal to be pulled up the brute would have held on, and the chances would have been that I should have had a broken arm. I had a hammer by me, but could not reach down to get it. There was a small iron bar about five feet from me, and with my foot I dragged this along until I could reach it with my left hand. And now the fight commenced; the more I struck him the tighter he squeezed, until my arm got quite benumbed. After a while I found the grip began to relax a little, but he held on until I had almost cut him to pieces, when he relaxed his hold from the rock and I pulled him up. I was completely exhausted, having been in that position for over twenty minutes. I brought the animal up, or rather a part of it. We laid him out, and he measured over eight feet across; and I am convinced that this fellow could have held down five or six men."

Women as Physicians.

In an article in the *International Review*, Dr. Chadwick makes the just observation that the question is no longer, Shall women be allowed to *practice* medicine? They are practicing it, not by ones and twos, but by hundreds; and the only problem now is, Shall we give them opportunities for studying medicine before they avail themselves of the already acquired right of practicing it? It is clearly the interest of the community to give to women the fullest instruction, in accordance with the most improved systems, and under the most eminent teachers; and also that their proficiency should be tested by the most rigid ordeals before they finally receive certificates. By a recognition of these certificates and their comparative values, the community would be able to protect itself from the impositions of ignorant or fraudulent pretenders to medical knowledge.

In this connection it will be interesting to notice the remarkable medical missionary work now going on in China, and the skill of an American young lady physician, Miss L. A. Howard, who has lately had the good fortune of restoring to health the wife of the great Governor-general Li-hung-chang, who entertained General Grant so handsomely. Rev. D. Z. Sheffield, of Tung-cho, North China, writes as follows to the *Missionary Herald:*

"Recent letters from missionaries in North China give intensely interesting accounts of the sudden providential inauguration of medical missionary work in Tientsin, on a grand scale, and under very remarkable auspices. The importance of this advance movement can hardly be overestimated, and it is not too much to be hoped that it will give a new impetus to every department of missionary effort."

Rev. A. H. Smith, of Tientsin, writes as follows: "Dr. Mackenzie, a medical missionary of the London Mission, was transferred to this city last spring, with a view to opening an extensive medical work here, which has never yet been done. A petition was presented to His Excellency the Governor-general of the province, Li-hung-chang, the most influential man in China, asking his co-operation. Owing, perhaps, to the arrival of General Grant and the ensuing excitement no reply was made. A few weeks since the wife of His Excellency, long an invalid, was so low that native physicians gave her up after administering all the most expensive drugs in the Chinese pharmacopœia, and, as they told the Governor-general, knew nothing else to do unless to begin and give them all over again! In this emergency two foreign physicians were summoned, who saved Madame Li's life. As Chinese prejudice forbids much that occidental civilization allows, it was necessary to a complete cure to summon a lady physician, which was done with the assent of His Excellency the Governor-general.

"Miss L. A. Howard, of the American Methodist Mission, arrived here early in August, and took up her quarters in a suite of three rooms near to Lady Li in the yamên, or official residence. Missionaries have occasionally been in the yamên of viceroys before, but it has generally been either in the capacity of beggars or as prisoners, never as physicians in charge. Miss Dr. Howard has lived in the yamên about three weeks, and Madame Li is so far recovered as to be considered well. The fame of foreign medicine has gone abroad with the highest indorsement. The foreign physicians operated in certain surgical cases in the yamên, and the patients made a successful recovery. As native doctors know nothing of surgery this is looked upon as a wonderful art. The Governor-general has not formally granted the petition referred to, but he has opened a dispensary in the largest temple in Tientsin, in that portion of it used as a memorial temple to his predecessor, the late Tsêng-kuo-fan. The medicines are furnished by the Governor general, and the missionary physician in charge has full liberty to preach the gospel to every patient. A few weeks ago such an event would have been considered utterly improbable. Its consequences can hardly be foreseen. Li-hung-chang is the statesman who last year remarked, during the famine relief, that there must be something in a religion which induces men to lay down their lives for total strangers of a

different nation. Little by little the great wall of Chinese prejudice is falling in pieces. As it falls Christianity enters."

Rev. Isaac Pierson, of the Pao-ting-fu station, who spent some weeks at Tientsin, writes at a later date: "A commission was sent (by Li-hung-chang) to Dr. Mackenzie, appointing him, in company with Dr. Irwin, physician to the yamên—the latter practicing medicine for a calling, being made the recipient of a salary which will equal five hundred dollars a year. Dr. Mackenzie was appointed, or commissioned, 'to heal the sick,' of the city, and a large yard with ample buildings was forthwith set apart to his use. This is part of the great temple of the city recently built by the same Viceroy—the temple in which he received and did honor to General Grant. Miss Howard has been promised a similar commission to treat the women, and is to have another court and buildings at the temple for her dispensary. The Viceroy promises to pay all the expenses of this dispensary work.

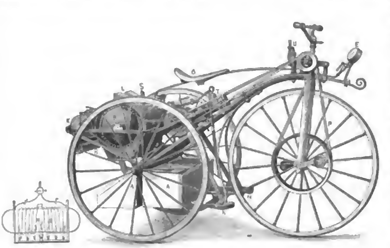
"For nearly three weeks the dispensary has been opened, and Dr. Mackenzie, assisted by our vice consul, Mr. Pethick, who has been indefatigable in his labor of love, has daily given treatment to eighty or ninety patients, in addition to an average of forty or fifty opium takers, who with medical help are trying to break off the habit of using opium. Many interesting surgical operations are performed. Four days ago the number of hare lips cured had reached eleven. There is a general of the army at the dispensary whose leg is being reset for an old fracture. Many other surgical operations have been successfully performed. In all this the Viceroy is intensely interested."

This feature of surgical operations, performed with the approval of the Viceroy, strikes one acquainted with the former prejudice of the Chinese against the use of the knife on the human body, as the most remarkable thing in this whole movement. In past years foreign physicians have not dared to let it be known that they had such a thing as a human skeleton in their house, and a few years ago, when Dr. Dudgeon was lecturing to the students in the Peking University on the anatomy of the human body, he dissected a sheep in their presence, as the dissection of a human body would not for a moment have been allowed. Mr. Pierson further says: "It has been said by some that a medical work could not be carried on here, but here is one already started, upon a basis superior in many respects to any in China, and with the strong presumption of its being a permanent one."

From these letters it will be seen how rare is the opportunity for medical missionary labor in North China. Preaching missionaries are already offering themselves to go and strengthen the hands of their brethren in that interesting field. No grander opportunity could be offered to the consecrated ambition of a Christian physician than that now offered. Urgent appeals are being made for physicians from the stations of Pao-ting-fu, Kalgan, and Tung-cho. Shall not the hearts of the brethren at the front be soon cheered with the glad intelligence that men are on the way to enter upon the work of ministering to men's bodies, and thus assist in the great work of ministering the bread of life to the famishing myriads of the heathen?

THE STEAM VELOCIPEDE.

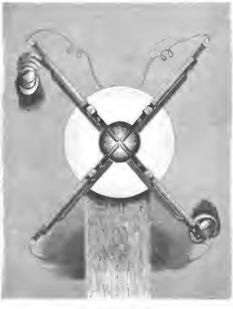
At the recent Industrial Exhibition at the Champs Elysées, Paris, M. Perreaux, of Orne, exhibited a steam velocipede, which is illustrated herewith. The generator, the fireplace, and the motor are arranged behind the saddle of the velocipede, after the manner of the portmanteau of a horseman. Chains or belts transmit motion from the engine to the wheels. All the parts are small, well put together, and very compact. The small tubular boiler is cylindrical and has a capacity of about three quarts; and at the sides there are two receptacles containing a sufficient supply of water to last during a journey of two to three hours. The piston of the engine is about one inch in diameter and has a three inch stroke. The whole engine is a mere plaything, and yet, with a pressure of three and a half atmospheres, it has sufficient power to drive the velocipede at a speed of from fifteen to eighteen miles per hour. The fireplace which heats the boiler is an ingenious novelty, and consists of a small gasometer fed by wood spirit. The vapor of the alcohol issues through holes, and gives a flame endowed with great calorific power. The fire is lighted at will, and in a few minutes steam is up. A method is provided for regulating the escape of the alcohol vapor, and consequently the intensity of the heat. Externally the boiler is furnished with two tubes rolled in the form of a spiral, so that the steam which is produced circulates through these continuously, and is exposed directly to the fire before entering the motor. The steam being superheated, no water is carried over with it. With a speed of eighteen miles an hour, the cost of alcohol consumed is from forty to sixty cents (this calculation, of course, for France). This is certainly not very economical, but it is very pleasant to have a horse under control which eats only when he works.



STEAM VELOCIPEDE.

THE ELECTRIC SUN.

At the recent Industrial Exhibition at the Champs Elysées Paris, M. Lontin exhibited an apparatus with which a very interesting experiment may be tried. This device, which the inventor calls the "electric sun," is composed of four carbons radiating from the same center, but not touching each other. Four currents are passed through these carbons in the following manner: The first current enters at A and issues out through the carbon B. The second leaves through this same carbon and enters through the carbon C. The third current enters through the carbon C, and leaves through the carbon D. The fourth enters through A, and



THE ELECTRIC SUN.

leaves through the carbon D, the result being a complete circle of light, which is due to the formation of four lateral voltaic arcs. The light obtained is exceedingly intense. This experiment proves that by this means foci of light of indefinite power may be obtained. When the carbons are further separated from each other flames are produced, not as they are under ordinary circumstances—with a diminution of light—but, on the contrary, with a considerable increase of it; and these flames sometimes attain a length of six inches, and quite often assume a forked shape. From whence comes this anomaly of a flame, augmenting the luminous intensity of the voltaic arc, and that too so strongly?

MISCELLANEOUS INVENTIONS

Mr. Harry L. St. Clair, of Winneconne, Wis., has patented an improved ironing table having pairs of legs which are hinged and jointed together in such manner as to adapt them to fold closely against the top.

Edwin T. Greenfield, of New York city, has patented an improvement in automatic electric switches for telephones. The object of this invention is to provide for an automatic switch a movable electric or magnetic conductor that by its own gravity shall make or break magnetic and electric connection.

An improved attachment for vehicle wheels, to strengthen the felly joints, and at the same time keep the tires in place upon the wheels, has been patented by Mr. Charles Cremer, of Cosumne, Cal. It consists in the combination of a cap plate, formed to fit upon the rounded inner edge and the sides of the ends of the fellies, provided with pins to enter holes in the inner edges of the felly ends, and having its side arms projecting to overlap the side edges of the tire, and perforated with countersunk holes to receive a rivet.

Mr. Carl J. Swanson, of Stockwell, Ind., has patented a pump that can be used as a force pump or as an ordinary suction pump. The invention consists in a stopper composed of an inner ring of elastic material, an outer wooden ring, and two flat metallic rings.

Mr. George Binns, Jr., of Brooklyn (E. D.), N. Y., has patented a process and mechanism for forming pipes or tubes of pulp, for use as non-conducting coverings for steam pipes, generators, hot air pipes, water pipes, and gas pipes, and for use as conductor pipes for gas, steam, sewage, water, and other liquids.

Mr. Emil R. Völkel, of New York city, has patented a new method of taping furs which is simple and effective, and produces a strong and durable fur. It consists in fastening the strips of fur to some suitable backing by means of adhesive materials.

An improvement in slop jars has been patented by Mr Maurice Stransky, of New York city. The object of this invention is to furnish slop jars so constructed as to prevent spattering when liquids are poured into them, and to prevent odors from escaping into the room.

Mr. Emanuel J. Trum, of Brooklyn, N. Y., has patented an improved blotter which consists of a pad made of alternate sheets or layers of bibulous and non-bibulous paper, glued together at their ends in a manner to facilitate their ready separation.

An improvement in velocipede sleds has been patented by Mr. James H. Dennis, of Newark, N. J. The invention consists of a saddle, an open wheel standard carrying an end pivoted screw, a lever fulcrumed and connecting at one end with the screw and pivoted at the other end to a rod hooking on a crank shaft carrying spike wheels.

An improved game bat, patented by Mr. James O'Neil, of New York city, is composed of thin strips of wood bent double upon a form, and secured one upon the other by cement. The strips are spread at the bend to the required shape for the bat and united at their ends to form the handle. Between the layers of the strips forming the bow a strip of vulcanized or other fiber is interposed for imparting greater strength and elasticity.

An improvement in saddle-girth rings, patented by Messrs. Arnold Jehnke and John Swank, of Denver, Col., consists in constructing girth-rings with teeth or shoulders to prevent the strands of the rope or girth from being crowded together, and also in providing the girth-rings with pairs of stop rings to allow the middle part of the girth-rings to be left free from strands if desired.

Meteors.

News comes from Missouri that a man has been killed there by the downfall of a meteoric mass. It is described as about as large as a bucket, and resembling iron pyrites. It cut its way through the branches of a maple tree as clean as a cannon ball could have done, struck and killed the man, and then buried itself two feet in the ground. At first, many supposed the account to be a cleverly invented story of the great gooseberry type, but it has been confirmed, according to Mr. R. A. Proctor, in the Newcastle (England) *Weekly Chronicle*. The chance of a death occurring in any given year by meteoric downfall is small, but not so exceedingly small as many imagine. It could readily be calculated if we knew the average number of meteorites, large enough to break their way through the protecting armor of the air, which fall each year upon the earth. We may fairly assume that each human being (including all ages) presents an average surface toward the meteoric missiles of about one quarter of a square yard. (We must, of course, take into account the circumstance that meteors do not fall vertically; nor are all men all the time afoot.) Assuming the number of human beings in the world at each instant to be about 3,000,000,000, the space thus occupied by the human race as a whole would be one quarter of 3,000,000,000 of square yards. (It will presently be seen why I leave the result in this form.) Now the earth's surface contains 200,000,000 of square miles, each containing (nearly enough for such a calculation as this) 3,000,000 of square yards. Hence the surface of the earth contains 200,000 times 3,000,000,000 of square yards, whereas the human race covers but one quarter of 3,000,000,000 of square yards. So that the human race occupies but 1 800th part of the earth's surface. Therefore, if 2,000 meteorites annually reach the surface of the earth, the chances are but as 1 in 400 that one of these will kill a human being. On the average one human being would be killed in 400 years. It is worthy of notice, however, that if Professor Newton, of Yale College, is right in asserting that 400,000,000 of meteors of all orders, down to those visible only in a telescope, fall each year, the

chances of death from meteoric downfall would be very great were it not for the very efficient protection afforded by our air. For in that case, as 400,000,000 exceeds 800,000 500 times, we might expect that on the average 500 persons would be killed each year. For the smallest meteor, traveling with planetary velocity, or many times faster than a cannon ball, would unquestionably be able to deal a fatal stroke. Fortunately there is no risk from these smaller meteors, for they are all vaporized in their rush through the air.

Wooden Pavements.

During a recent discussion of the American Society of Civil Engineers in this city of a paper by Mr. E. P. North, on "The Construction and Maintenance of Roads," Mr. Edward R. Andrews made the following interesting remarks:

Mr. North states that a well made macadam road constructed with trap rock is, after an earth road, the pleasantest and safest known. But trap rock or other really good materials for making macadam roads are not available everywhere, and at best macadam roads are only adapted for pleasure travel in parks or suburban towns, where they can be constantly watered and never allowed to get out of repair. Macadam is not adapted for general use in cities. Under heavy traffic, the surface is constantly ground into powder, which rises in dust in the summer, and they are very muddy in the winter. Even in Paris, where the maintenance is most thorough, the streets being continually watered in summer in the manner described by Mr. North, and frequently washed after a day of unusual wear, and scraped by a large army of cantonniers, yet, after heavy rains, the mud is frequently nearly ankle deep, and in very hot weather during the intervals of watering, or in frosty weather, the air is filled with most penetrating dust. Mr. Flad describes the same state of things in St. Louis; and, in Boston, when, in winter, there is no snow to cover the ground, and on account of the cold, the streets cannot be watered, the dust is intolerable; and in summer, where, for economy's sake, watering is neglected, a large part of the material with which the roads are made is blown into the sea.

The compressed asphalt, so common in London and Paris, when constructed as thoroughly as it is in those cities, and as that on Fifth avenue in front of the Hotel Brunswick has been, is a most excellent pavement, but it also demands the most careful maintenance. No dirt should be allowed to accumulate upon it. In frosty or in damp weather, coarse sand or fine gravel should be spread over the surface to give a good footing for horses. This is done abroad, and then it is not slippery; it is very quiet, and in fact has almost all the qualities needed in a perfect pavement, but it can only be laid on levels, and is expensive.

Stone block pavements are in many parts of the country the cheapest, and possibly may be the best where the traffic is very heavy, but it is emphatically the worst pavement for streets of residences or wherever quiet is desirable; and there is no question but that if the incessant din from the rattling of omnibuses, heavy teams, milk wagons, etc., from which one suffers in large cities paved with stone blocks, could be dispensed with by adopting a quiet pavement, the length of life of citizens would be increased and the general health improved. Such would have been the case long ago in New York had it not been that the wooden pavements laid during the "Tweed" days were such evident jobs. In London, wooden pavements give entire satisfaction. The earliest were not quite successful, but the defects in construction have been remedied, and now broad areas of heavily worked streets previously paved with stone are being laid with wooden blocks, which are found to wear satisfactorily.

In the West, where stone for pavements cannot be had, wooden blocks are largely used; but, as wood is cheap and can be replaced without much expense, no sound principles are followed in their construction. In the Eastern States, no one will allow that a wooden pavement can be good except when newly laid, when all agree that it is delightful. There seems to be an unwillingness, even among engineers, to give the subject the attention it deserves. All agree that stone pavements are a curse, and that it would be a blessing if a good substitute could be found, but because wooden pavements, as they have been made here, have not been a success, condemn them as a class.

Mr. North has stated what has been the general practice in laying wooden pavements in this country. Many methods have been tried, but they have almost without exception been "laid with *green* or wet blocks, more or less thoroughly dipped in tar, on a bed of sand, not always well rammed, with or without the interposition of a tarred pine board, with transverse joints from one to one and a half inches wide filled with gravel and coal tar," and I might add, the whole done in a most unworkmanlike manner.

The results are what might have been expected. The careless manner in which the joints have been filled, has left many channels open for the admission of water, which undermines the sand foundation, so that there is an uneven subsidence under the passing wheels, and holes, small at first, but daily growing larger, appear, so that the surface is soon destroyed. The result is but little better when tarred boards are laid under the blocks. This practice of tarring wet, sappy boards and blocks seems to be an invention to make them decay as soon as possible. It closes up the cells of the wood, so that the moisture cannot escape; fermentation immediately follows, which quickly destroys the strength of the fibers and reduces them to punk. A pavement, constructed in this manner, would fail of course. Thoroughly seasoned wood might be benefited by the tarring process, but green wood never.

Observe how differently wooden pavements are constructed in London. Mr. North describes several methods, either of which is vastly superior to any of the patented systems used here. A rigid foundation of bituminous or cement concrete is universal. This costs more than sand, but it is permanent, and will prevent the blocks from sinking under the wheels. English engineers, in discussing pavements, call the foundation the true pavement, the blocks being the wearing surface only. The "Henson" pavement, with some modifications, strongly recommends itself to my mind as the best for this country. Instead of a layer of tarred paper on the concrete, I would use a thin layer of pitch, with oil enough in it to make it permanently slightly plastic, setting the blocks upon it while hot and soft, using the strips of tarred felt between the rows, and driving the blocks together as described by Mr. North. The tarred felt would make a very close joint. Then pour melted pitch over the whole surface, taking care to fill every crevice, and upon this spread fine sharp gravel, which will work into the ends of the blocks and form a surface resembling macadam, and afford a far better footing than wide spaces between the rows, which serve as receptacles for mud and dust. It is easy to keep this pavement clean. No water can penetrate it, so that it will not be injured by frost. The blocks themselves, if creosoted, will not absorb water, and if laid without spaces between the blocks, the drainage will be surface drainage solely, which is of the first importance.

But the pavement would be short-lived if *green* and wet blocks are used. It is not practicable to use, as Mr. North says is the case in London, "wood better seasoned than the pine generally used by house carpenters in this country." Seasoned wood cannot be obtained in sufficient quantities here. But, what is far better, it can be preserved from decay. I have no faith in any method of wood preservation for paving blocks which does not exclude water. The blocks are so short that any soluble preparation is quickly washed out of them, and, if not made waterproof, they are certain to absorb the seeds of destruction from the filth in the streets. The blocks should be well saturated with creosote oil, whose chemical constituents act preservatively upon the fibers of the wood by coagulating the albumen of the sap, while the fatty matters act mechanically in obstructing the pores of the wood and keep the water out. At the same time, as oil cannot be injected into wood full of moisture, the thorough artificial seasoning, which forms a part of the process of creosoting as carried on in this country, is as useful to the timber as any of the metallic salt processes.

By thoroughly creosoting the blocks, expansion and consequent throwing out of the blocks is prevented. They will not shrink or expand. The wood is also rendered homogeneous; the sap wood becoming as durable as heart wood. Looking to sanitary considerations, the creosoted wooden pavement is perfect. The carbolic acid contained in the oil is a powerful disinfectant, and as the pavement described will not absorb any deleterious substance from the surface, it has only to be kept clean to maintain the best sanitary condition. This is far from being the case with wooden pavements laid on the American plan. They soon become a mass of decaying vegetable matter, and, as their powers of absorption increase with their disintegration, they become filled with corruptible matter absorbed from the filth of the street; and as their surface becomes filled with holes, it is absolutely impossible to keep them properly clean.

A good wooden pavement is also an inexpensive one. The cost, including a cement concrete foundation, 6 inches deep, would not exceed $4 per square yard. The system of maintenance adopted in London, of making it a part of the contract of construction, would insure good workmanship in laying the pavement, and a good permanent roadway afterward. It would not be difficult to find responsible and honest contractors willing to take such a contract at a fair price.

In considering this subject, one should not overlook the statistics of accidents gathered in London by Col. Haywood, which show that a London horse will travel on granite 132 miles, on asphalt, 191 miles, and on wood, 446 miles, before an accident occurs.

The actual wear of wooden blocks is very slight, as long as the fibers of the wood are sound. Mr. North states that it is one eighth of an inch per annum in the streets in London, with the heaviest traffic. Mr. Geo. Frederick Deacon, Member Inst. C. E., in a paper read before the Inst. of C. E., states that in Great Howard street, Liverpool, which is a shop street, with a traffic consisting chiefly of carriages, amounting to about 94,000 tons per annum per yard in width, the pavement was worn to the extent of ⅝ of an inch in four years. This would give a life of nearly twenty years before the blocks would be reduced from 6 inches to a thickness of 3 inches, which is still sufficient to maintain the blocks in place.

In Oxford street, in London, where the traffic is equal to 800 tons per foot per day, the amount of wear has been found to be from 1-16 to ⅛ inch during three and a half years. This street is laid with the Henson pavement. This slight wear is largely due to the fact that the ends of the fibers do not broom, and thus retain their original strength.

The cost of creosoting is $12 to $16 per thousand feet, board measure.

Spruce does not absorb oil readily on account of the compact character of its fibers, yet it will take in a gallon of oil per cubic foot; hemlock, pine, both white and yellow, and porous oak, are more absorbent. Wood which is the most destructible, because it absorbs water readily, is really the best for creosoting, as, for instance, the gums and cotton-wood.

The amount of carbolic acid in the oil I have not taken any pains to ascertain. The quantity depends upon the character of the coal from which the gas was made, varying from 5 to 10 per cent. It has been ascertained, however, through careful experiments by a Belgian chemist, that the wood preserving qualities of creosote oil are due rather to the waterproofing imparted to the wood by the hydrocarbons contained in it than by the carbolic acid. The latter is very volatile, and were it not retained by the gummy, resinous oil would quickly escape into the air. In England no reference is made to the quantity of carbolic acid contained in dead oil to be used in the specifications for contract work. Carefully conducted experiments of my own with pieces of yellow pine, 8 inches by 8 inches and 9 feet long, have shown that six months after treatment they did not absorb any water during a soaking of 48 hours under water.

ENGINEERING INVENTIONS.

An improvement in moulds for sewer building has been patented by Mr. James Burns, of San Antonio, Texas. This improvement relates to moulds or centerings for use in building sewers of concrete, artificial stone, or brick; and it consists in a collapsible mould, made of convenient length, and of the cross sectional shape required for the sewer, and fitted on wheels, so that the sewer can be built in sections around the mould and the mould moved along the trench from time to time as the sections are completed.

An improved railroad switch, patented by Mr. Conzac S. Bastright, of Lebanon, N. H., is so constructed that the wheels of a train of cars advancing from either direction will bring the switch rails into line with the rails of the main track should they be in line with the side track, so that a train cannot run from the main track to the side track unless the switch rails be purposely arranged to produce that result.

Mr. Robert Schneckenburger, of Jackson, Mich., has patented an improved self-adjusting packing designed for rotary engines, rotary pumps, blowers, air compressors, etc. The invention consists in a rotary engine one of whose cylinder heads has a steam passage and apertures connected by a groove in combination with a packing strip.

Mr. Peter Barclay, of East Boston, Mass., has patented an improvement in lubricators for steam engines, wherein the oil is caused to flow in regulated quantities by means of steam pressure. The invention consists in a cup having a perforated diaphragm near the bottom, by which a general pressure on the oil may be obtained without any condensing tube in the cup.

Messrs. Franklin O. Wyatt and Edwin Smedley, of Dubuque, Iowa, have patented an improvement in iron trucks for locomotive tenders and railroad cars, the object being to construct a strong and durable truck, capable of withstanding severe shocks without tearing asunder, and which, after being bent, may be restored to shape.

Gold and Silver in Maine.

Important mining discoveries have been made in Maine during the last few months. Companies have been organized, and work is being energetically prosecuted in various parts of the State. The deposits are principally of gold and silver. The Acton lode, in York county, is reported by Professor Stewart to be one of the best defined fissure veins on the continent. It has been traced for two miles from north to south in nearly a right line, and the surface exposures show that it ranges in lateral diameter from eight to twenty feet. The Riverside Mining Company has been organized at Camden, in Knox county, with a capital of $500,000. Work was begun about six weeks ago, and is being pushed night and day. The shaft of the Fort Knox mine, at Prospect, opposite Bucksport, on the Penobscot River, is now down sixty-two feet, and the ore from the bottom contains both gold and silver. A fine specimen of very rich ore from the Deer Isle mine, on Deer Island, Penobscot Bay, has just been exhibited in Bangor. An assay resulted as follows: Gold, $30; silver, $60; copper, $10; lead, $17. The Owl's Head mine, seven miles below Rockland, at the mouth of Penobscot Bay, is showing specimens of quartz very rich in gold. The Hampden Mining Company has a shaft eight miles westward from Bangor, which is down sixty-five feet, and blasts throw out ore of good quality. The Atlantic mine, at Blue Hill, is equipped with steam engine and drills, and the shaft is already sunk over fifty feet. The assayer of the Blue Hill Mining and Smelting Company writes, under date of the 11th January, that things are progressing at a lively rate. Five or six other mines report favorably, and important additions to their outfits will be made in the spring with a probable enlargement of operations.

MAGNESIUM STEEL.—A half per cent of magnesium changes coarse grained into fine grained steel and greatly improves the quality. The magnesium is introduced through an opening in the cover of the crucible, after inserting some small bits of charcoal, in order to remove the free oxygen. Without this precaution there would be danger of an explosion.—*Ber. der Chem. Gesell.*

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

In the advertisement of H. W. Johns M'f'g Co. in last issue of this paper, the words felt packing should read flat packing. The advertisement as now inserted is correct.

Parties manufacturing Traction Engines suitable for log hauling are requested to correspond with Drew & Buckl, Suwannee Steam Saw Mills, Ellaville, Florida.

Mica in sheet and scrap for sale in quantity to suit. Parties using Mica in any form please send for samples. Atlantic Land and Mining Co., Box 2762, Leadville, Col.

A No. 6 Root Blower, steel shafts of extra strength, and used less than four months, in good order. Charles L. Oudesluys & Son, 67 Exchange Place, Baltimore, Md.

Wanted.—A live man (engineer preferred) to introduce the "Hydrostatic" Joint, for gas and water mains. A lead joint and the best in the world. A good opportunity for a competent man. W. Painter, 44 Holliday St., Baltimore, Md.

Asbestos Wick Packing for Valve Stems, etc., is one of the most desirable articles ever produced for use around steam. It is practically indestructible. H. W. Johns M'f'g Co., 87 Maiden Lane, are sole manufacturers of genuine Asbestos materials.

New Economizer Portable Engine. See illus. adv. p. 108.

A New Fruit Jar. Simple and durable; easily opened; no mouldy fruit. Territory for sale. Address C. A. Barnes, Lockport, N. Y.

Portable Railroad Sugar Mills. Horizontal and Beam Steam Engines. Atlantic Steam Engine W'ks, B'klyn, N.Y.

Portable Forges, $12. Roberts, 107 Liberty St., N. Y.

For Sale.—Foundry and Machine Shop, third city in State; good business. Box 775, Winona, Minn.

For Sale.—Horse Detaching Patent. Best ever invented. W. R. Kitchen, Willard, Ky.

Hydraulic Jacks and Presses. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Steam Engine for sale very low. See advertisement on another page.

A Rare Chance.—We have on hand a 40 H. P. Horizontal Oscillating Engine, built for special work, but never used. It is first-class in all respects; has patent guides to prevent wear; has balance wheel, but no pulley. Price $250. Beald, Stace & Co., Baldwinsville, N.Y.

For Sale.—One Wood Turning Lathe, 20" swing, 14 ft. bed. Jig Saw and Face Lathe, for pattern work; also Blacksmiths' Tools. D. Frisbie & Co., New Haven, Conn.

Campbell's Self-acting Window Shade Rollers are the best in the market. Models and terms to the trade. 64 Centre St., New York.

Cheapest Portable Forges. H. Cranlish, Buffalo, N.Y.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $30. Attached to any instrument. T. Shaw, 915 Ridge Ave., Phila.

Partner Wanted.—See advertisement on inside page.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Collection of Ornaments.—A book containing over 1,500 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., etc., sent post free on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 110.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 94.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

For Sale Cheap.—The entire patent for best Egg Beater ever put on the market. See illustration in this number of the SCIENTIFIC AMERICAN. Address H. C. Mann, Frankford, Pa.

Forge, for Hand or Power, for all kinds of work. Address Keystone Portable Forge Co., Phila., Pa.

Solid and Opening Die Bolt Cutters, Screw Plates, and Taps. The Pratt & Whitney Co., Hartford, Conn.

Silent Injector, Blower, and Exhauster. See adv. p. 109.

The Paragon School Desk and Garretson's Extension Table Slide manufactured by Buffalo Hardware Co.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Linen Hose and Rubber Hose of all sizes with or without coupling. Greene, Tweed & Co., New York.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien M'f'rs, 23d St., above Race, Phila., Pa.

Machine Diamonds. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 110.

For Pat. Quadruple Screw Power Press, see adv., p. 108.

Steam Cylinders bored from 2 to 110 inches. I. B. Flanders Machine Works, Philadelphia, Pa.

Valve Refitting Machine. See adv., page 110.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Walrus Leather, Solid Walrus Wheels; Wood Wheels covered with walrus leather for polishing. Greene, Tweed & Co., 18 Park Place, New York.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 45.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Power Hammers. P. S. Justice, Philadelphia, Pa. p. 77.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., and 96 Liberty St., N. Y. city, U.S.A.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 71. Totten & Co., Pitts'g.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 108.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 120 Broadway, N. Y.

NEW BOOKS AND PUBLICATIONS.

MILLS' DIRECTORY OF STEAM BOILER AND ENGINE OWNERS, ENGINEERS AND STEAM USERS IN NEW YORK AND BROOKLYN. New York: Jas. N. Mills. Price $3.

Business men having dealings with engineers and steam users will readily appreciate the value of 6,000 names and addresses in lines in New York and Brooklyn. The book is neatly made.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) E. F. J. S B., and others.—The dose of salicylic acid recommended for rheumatism is from 5 to 10 grains two or three times a day.

(2) F. H. H. asks: What danger is there in an ordinary coal oil lamp (lighted) when about one third full, or has a large space between the oil and top of lamp? What does the space contain—explosive gas or atmospheric air? A. Unless the best quality of kerosene is used there is great danger of an explosion, as the lower grades of oils give off vapor at ordinary temperatures which, when mixed with a certain proportion of air, form an explosive which requires only fire to develop its power. Many lamp burners are so contrived that it is possible for fire to run down in the wick tube and ignite the explosive below.

(3) C. F. A. asks: Will you be so kind as to inform me, through the columns of the SCIENTIFIC AMERICAN, the relative cost and economy of the rotary engine as compared with other forms of the steam engine? A. While the cost of rotary engines is generally somewhat less than that of the reciprocating, they have never yet been made to equal the latter in economy. The relative economy depends upon the character and construction of the rotary.

(4) E. H. M. asks: Will shellac varnish form a sufficient insulator for the wire in the bells of a magnet for telegraphic purposes? A. Yes, if carefully applied and wound before it becomes so dry and hard as to crack.

(5) P. S. asks whether it is possible to obtain an electric shock by simply holding the poles of a battery, or must I have a machine? A. You will require an induction coil like that described on p. 203, Vol. 39 (11), SCIENTIFIC AMERICAN.

(6) W. H. writes: I have a job in which there is one radiator that fills with water for about 30 minutes; it cracks and makes a great noise. Please tell me the reason of water and noise, and how to remedy it. I will give you the way the pipes are placed. I start from the boiler with a 2 inch main to the first riser to 1 radiator, then I reduce to 1½ pipe to the next riser to 1 radiator, and then reduce to 1¼ to next riser to 1 radiator, and from this to the fourth and last radiator I reduce to one inch; there is about 30 feet between the two last radiators. It is the last or furthermost from the boiler that is not working right, the second and third risers go to radiators on the third flat; the first and last are on the ground floor or store; the full length of the main from boiler is 65 feet. A. You do not send sufficient data for an intelligent reply, but judging from the action of the water and the noise, your pipes must be too small, or reduce in size too soon. According to the description given, a 1¼ inch pipe has to supply steam to every radiator except the first one. When the area of a 2 inch pipe is represented by 4, a 1¼ inch pipe is represented by 2½, which in practice for long lengths should not be valued higher than 2. On page 226, No. 21, Vol. xli., it says: "Mains which have given the best results leave the boiler of sufficient size, and reduce very slowly, if at all, until very near the end."

(7) I. M. asks: 1. What is the horse power of an engine; cylinder diameter, 18 inches; stroke, 20 inches; revolutions per minute, 165; boiler pressure, 80 lb.? A. If you call the average pressure on the piston 30 lb. = 218 horse power. 2. Where can I get and what is the best work on mechanical engineering and management and care of steam engines and boilers, and what it will cost? A. "Roper on Land and Marine Engines," "Edwards' Catechism of the Marine Engine," for sale by industrial publishers who advertise in our columns.

(8) J. C. J. asks what books to buy on steam engineering. A. See reply to I. M., above.

(9) C. H. C. writes: I have six cells of a battery, the outer cup or jar is glass, and into this fits a porous cup containing a carbon core and some other ingredients. I also put in the bottom of the cells salammoniac, to produce the electricity. The point I desire to ascertain is, How much salammoniac should I keep in the cells to insure it in a working condition at all times? A. Enough salammoniac should be placed in the cell to form a saturated solution. It will do no harm if some of the crystals are left undissolved in the bottom of the jar.

(10) "Printer" asks: 1. Will a windmill run a cylinder printing press having a reverse motion unlike others? A. We think the speed would be too irregular. 2. Does a windmill always run machinery in the same direction? A. Yes. 3. Can it be regulated as regards speed by anything like a governor? A. Yes; governors are generally used in connection with the best windmills.

(11) H. L. B. asks: 1. Are the wheels of the Hudson River steamers Vibbard and Powell placed precisely amidship? A. They are not precisely in the middle of length, and we do not know their exact position. 2. What are the Powell's dimensions and size of engines and boilers? A. Length 250 feet by 34 feet beam, out to out, by 9 feet 4 inches hold; engine, 72 inches cylinder by 12 feet stroke; 2 boilers, 10 feet diameter of waist, and 23 feet in length.

(12) J. P. M. asks: 1. Is there anything better than a lever to secure a great power in a small space where but little motion is required? A. You might employ the principle of the hydraulic press. 2. If a system of compound levers is used, and not enough motion, can any arrangement be made that will give the increased motion without diminishing the power? A. No.

(13) C. M. writes: I see in No. 2 of SCIENTIFIC AMERICAN of 1880, in query No. 11, of W. S. W., how to find the cubic contents of a cylinder, your answer is to multiply the diameter by the decimal 0.7854. I wish to make a correction. It is to multiply the square of the diameter, that is the diameter multiplied into itself, by the decimal 0.7854 to get the area, then multiplying by the length you get the cubical contents. [You are correct. By some oversight the diameter was given for the square of the diameter.]

(14) H. S. C. asks: 1. How many bushels of coke will it take to melt 1,000 lb. iron in an ordinary medium sized two tuyere cupola? A. From 240 to 280 lb. to one ton. Much depends upon the form and proportions of cupola. 2. How many pounds of coal will it take to melt same amount under same circumstances, bed in both cases to be counted in, whole heat to melt about 10,000 lb. iron, in four charges? A. With anthracite coal and good furnace, from 10 to 12 lb. iron are melted to the pound of coal consumed. 3. About how many bushels of coke will a ton of bituminous coal make if coked to best advantage? A. From 60 to 75 per cent of weight of coal.

(15) E. S. E. writes: A company of gentlemen have agreed to ask your opinion upon a question which hopelessly divides them. I maintain that the reason a railroad engineer is placed upon the right side of his locomotive (thereby compelling him to use his left hand to control the levers) is because it is natural for him to do so; that is, the instinctively uses his left hand for many delicate operations, and his right where strength is the main requirement. In violin, and occasionally in piano playing, this appears. My opponents say that the mentioned peculiarity of locomotives is accidental. I contend that there is a reason for it, and that it is only a recognition of a fact, which though not explainable, is patent to all. A. There is no special reason for the position of the engineer except habit and custom. Some years since, on several railroads the engines passed on the left side of each other, that the engineer might have a clear view of approaching trains; but we believe that in every case they have now changed to pass on the right, as is now the rule.

(16) F. H. L. writes: 1. Suppose a windmill built with sails in the ordinary manner, but not turning to face the wind, and suppose friction, etc., reduced to a minimum. Would the number of turns per minute vary as the velocity of wind, when the wind was in the direction of the axis? That is, if n = number revolutions per minute, v = velocity in miles, and C some constant, should we have $n = Cv$? A. Yes, the pressure is as the velocity. 2. If the wind made an angle, A, with the axis, should we have $n = Cv \cos A$? A. Whatever angle the course of the wind makes with the axis, the speed will vary as the velocity of the wind so long as the direction is unchanged.

(17) H. M. asks: 1. What are the chemical properties of telegraph wire? Which of its separate properties act as a conductor of electricity? A. All metals, as well as many non-metallic substances, are to a certain extent conductors of electricity. The precise manner in which electricity is transmitted through these is not definitely known. As to the chemical nature of metals, consult some elementary work on chemistry. 2. Is there anything of a transparent nature a conductor of electricity—either a liquid or solid, solid preferred—that will not be affected by the current? A. We know of no such substance. Acidulated water conducts electricity, but slowly suffers decomposition by its action.

(18) Short Hand.—"Student" and others ask: 1. What is the best system of short hand? A. There is no demonstrably "best" system. Any one of numerous systems in use will serve well enough as a basis for the beginner. Ultimately every successful reporter has to develop his own system in accordance with his experience and the requirements of his own hand and mind. The man who has the rare qualifications of quick and tenacious memory, unlimited patience, nice discrimination of form, and capacity for manual skill, requisite for rapid reporting, will succeed with any system. Some of the most successful reporters have based their writing on ordinary script. 2. Can short hand be learned without a teacher? A. Probably nine out of every ten reporters have acquired the art without a teacher. A good teacher, however, will be of great assistance to the learner. 3. How long will it take to learn to report? A. Three months under good instruction, with several hours' daily practice, will suffice for easy work, proper capacity and industry on the part of the learner being assumed. The great majority of those who attempt the art, however, fail to acquire skill enough, after years of practice, to report a fairly rapid speaker. 4. Are there any good books on the subject? A. Any bookseller's list will show numbers of them, each and all guaranteed to be the very best. 5. Is reporting a profitable occupation? A. No, generally speaking. Still there is no occupation which cannot be made to yield a living, often very much more, to any one of proper capacity who will pursue it with prudence, zeal, and energy. Considering, however, the great time and labor required to master the art of short hand reporting and the low average reward, the occupation is not an inviting one. Nevertheless as an auxiliary to other lines of business short hand is well worth studying by any one who has time for it. The incidental training of hand and eye and memory is valuable.

(19) R. B. N. asks (1) how to cut carbon sticks in the best manner. A. A hardened steel point drawn along a straight edge, and at the same time pressed against the carbon with considerable force, will cut it if the strokes are repeated a sufficient number of times. 2. What mixture with bichromate of potash is used in the battery which consists of a zinc plate suspended between two carbon plates? A. Dissolve 2 parts of bichromate of potash in 20 parts of warm water. When cold add slowly 1 part of sulphuric acid. 3. Is there a cheap device by which I can wind wire on an iron core for an induction coil? A. See directions for making an induction coil, p. 203, Vol. 39, SCIENTIFIC AMERICAN, and SUPPLEMENT, No. 160.

(20) W. H. A. writes: There are being constructed in Illinois a line of towers extending longitudinally across the State, made of wood, frame of pyramidal shape, ranging from 125 to 200 feet high, from 1 to 3 miles apart, as we understand. What is their purpose? A. They are used by the engineers in the United States Survey Service in triangulation.

(21) G. S. J. asks (1) if platinum is fusible in the electric arc of the ordinary carbon lamp. A. Yes. 2. Is there any substance that is not fusible in the electric arc, and at the same time a non-conductor of electricity? A. There is no known substance that has these qualities.

(22) L. M. writes: 1. All our machinery is not having been run more than four months. We have a battery of flue boilers, one of which has on the first sheet a flaw in the iron above the fire box about 1-3 of the way up the side of the boiler; it is about 12 inches long and has a ragged appearance. This outside shell is about ⅜ thick. The boiler is of ⅜ plate. We carry 80 to 95 lb. steam. Do you think it is dangerous to run it in this condition? A. Yes; repair your boiler before using. 2. Our hoisting engines are strongly built, size of cylinder 12x20, the best time we can make is 9 seconds; throttle open wide, 90 lb. steam. The coal is hoisted one hundred feet out of a shaft. How can I make the engines quicker without increasing the steam pressure? The valves have ⅛ lead, ⅝ lap steam cut-off at ¾ stroke. A. We think you cannot make them quicker, if you have now proper size of openings. 3. Is there any such an invention as an apparatus for opening the doors of locomotives by means of levers or springs? A. We know of no such thing in practical use.

(23) W. F. asks (1) why an engine in making a curve will travel more on the high than on the low side. How do they do it when the wheels on both sides are making the same number of revolutions? A. The face of the tire is generally "coned," and the outer wheel runs on a larger diameter; also, the inside wheel slips or slides to a certain extent, depending on the radius of the curve. 2. On what principle does an injector work? A. By the velocity and consequent momentum given the water by the effluent steam.

(24) V. V. G. asks: Will a locomotive without train, with a 4½ foot wheel disconnected on one side, be equal to a 9 foot wheel? Will a locomotive run faster with one side disconnected? A. The locomotive will not travel faster than the wheel travels. Disconnecting one side makes no difference so long as the wheels have the same velocity.

(25) R. H. D. asks: What is the best way to irrigate a strawberry field, ½ acre, water to be taken from a lake, highest point 9 feet above low water; greatest distance 200 feet; time water is wanted, during the month of June? I can pump in a tank by hand and spread by gravity, or draw with team and self-dis[illegible] tank attached under wagon. Is there a better or cheaper plan? A. Put up a windmill to pump into your tank, and spread by gravity.

(26) W. F. H. writes: We had a 40 horse power tubular boiler to test with water pressure; took the water from a pond covered with ice, boiler was out doors; thermometer about 26°, or 6° below freezing, cloudy day; gave it a pressure of 130 lb. in that condition. How much steam pressure would it be equal to? I claim it would be as hard on the boiler as 150 lb. steam or hot pressure. A. It would be harder on the boiler, because the water has no elasticity, while the actual pressure would be the same. The iron would also be more brittle at the low temperature.

(27) A. B. P. writes: I have a large cistern, and the pipe that feeds my boiler is constantly five feet under water. Would it be injurious to the boiler, or in any way objectionable, to let the exhaust from the engine into the cistern at the top of the water, if I use country tallow only in the cylinder? A. No, unless you use the tallow in large quantity.

(28) G. H. C. asks: 1. What was the depth of girders and what was the width from outside to outside of same across the track on the recently destroyed spans of the Tay bridge? A. Depth 27 feet, width between girders about 12 feet. It was a single track bridge. 2. Are hexagonal nuts ever used on bolts in fish plates in this country, or are they all square? A. They are almost invariably square. 3. Is a fish plate bolt screwed up tight as any other bolt in any piece of machinery, or is it left moderately loose to admit of expansion and construction of rails? A. It is screwed up tight, but the fish plate has a little elasticity.

(29) A. O. K. writes: 1. I have charge of a boiler of the locomotive type. I have considerable trouble with leaks at the bottom of the water legs, caused by fractures in the cast iron "ring" surrounding the fire box. Calking does no good; I have also tried a cement of iron turnings, salammoniac, and sulphur, placing it on the cracks, but that also failed to stop the leaks. Bran does better, but does not stop them entirely. How can they be stopped effectually? A. First use coarse Indian meal on the inside, and when it has worked well into the cracks, fill above it with hydraulic cement 1 to 2 inches thick, being careful that the top of the cement is some distance below the top of grate bars. 2. I want to black small casting by dipping. Can you give a recipe for a paint for this purpose that will have a gloss after becoming dry? A. Use asphaltic black varnish.

(30) A. R. B. writes: Riding with a friend recently, he asserted that the wagon brake produced greater effect in retarding the vehicle when barely allowing the wheels to turn, than when it locked them entirely. I said he was mistaken, but could give him no satisfactory reason. Am I right, and if so, please explain why? A. Your friend is correct. It is true also of railroad brakes when the wheels are locked; the same surface is constantly presented for friction and soon becomes glazed; when allowed to turn, new surfaces are presented.

(31) C. E. B. asks: 1. Of what kind of metal is the rings in an engine cylinder composed of? A. Generally cast iron. 2. How can I run Babbitt metal boxes for a saw mandrel or other shafts? A. Fit a mandrel the size of the shaft in the box and cast around it.

(32) J. H. W. asks for a recipe for a toilet lotion that will improve complexion of ladies, which contains nothing injurious. A. We do not recommend such lotions. Temperate living, plenty of out-of-door exercise and frequent bathing impart a clear vigor to the skin attainable by no artificial means.

(33) J. F. P. writes: I have a well that is 20 feet deep, and I have a pump with 1 inch gas pipe; it is common iron piping. The water tastes a little of the iron. How can I keep it from tasting? A. Use wood tubing instead of the iron pipe.

(34) J. C. S. asks: How can cattle hoofs or horns be melted so as to form a transparent composition? A. Horns are soaked in hot water until the bone is easily separated, when they are softened in hot water, slit up, and spread out between warm plates under pressure. From these plates the articles referred to are cut. Hoofs are usually cold pressed. Neither are melted as suggested.

(35) J. A. W. writes: Can you tell me the usual way of covering lead with powdered chromium for negative plates, and do you consider such plates equal to carbon? Do you know of an imitation or any substitute for hard rubber? A. The metallic chromium, according to Beasley, is pressed into the surface of the lead by passing between steel rolls. It compares favorably with carbon in some electrotypes. Celluloid can be made to closely resemble ebonite or vulcanite.

(36) J. S. writes: I wish to build a small steam launch of the following dimensions: Length over all 25 feet, beam 5 feet, depth 3½ feet. Boiler 24 inches diameter, 36 inches high, 90 or 100 one inch tubes. Engine, cylinder 5 inches by 8 inches stroke, working pressure 150 lb. The exhaust steam to be led through the bottom of the boat and along the keel to and around the stern, then forward and empty into a tank in the boat. The diameter of the exhaust pipe will be 1¼ inches, length about 80 feet under water. Will 80 feet of 1¼ inch pipe have enough surface to condense all the steam; if not, how long ought the pipe be? A. No; do not use less than 2 inch pipe.

(37) R. E. W. asks: By what process is condensed milk made? A. The fresh milk is pumped into large air tight vessels (vacuum pans) placed over a warm water bath and connected with air pumps, by which a partial vacuum is maintained within them. Under these circumstances the milk boils and parts with its water at a very low temperature. Where the milk so condensed is to be preserved for a very long time, it is mixed with a certain per cent of pure white sugar and put up in hermetically sealed cans.

(38) A. B. F. asks (1) for the dimensions of a scow that will carry about 40 tons of freight in addition to her engine, and not draw over 18 inches of water. A. About 75 or 80 feet long and 15 feet beam. 2. What would be the power of an engine to drive it at about 4 miles per hour with a stern wheel? A. Two engines, 6 inches cylinder and 2 feet stroke. A. Which is best for such a boat, an engine with one cylinder or one having two cylinders? A. Two engines.

(39) F. A. S. asks: 1. Is it true that Bessemer steel cannot be used for mould boards for plows, or bottoms of road scrapers. A. Yes. 2. Is it because such steel cannot be properly hardened? A. Yes. 3. If it cannot be made sufficiently hard, why is it? A. It contains too little carbon to be materially affected by the ordinary hardening processes.

(40) J. B. R. writes: I have a private telegraph line, two wires, ½ mile long. The line is annealed wire, such as tin men use in putting up stoves. The line has been in use three years. It has been broken several times and spliced. I use three cells Watsons battery to charge the line. It works good for three or four days, then it ceases to work until I cross the wires in the office for a few minutes, then it will work again as stated. Why will it not work all the time? The current is very strong when I cross the wires in the office. A. Without further data we cannot explain the action of your line. It is probable, however, that the resistance of your line is excessive. Use regular telegraph wire. If you require a small wire, use copper.

(41) F. H. L. asks if there is any composition of brass that can be melted in an ordinary coal stove that is of sufficient hardness to cast small models from and its composition. A. Common yellow brass may be readily melted in a coal stove, but it is doubtful if brass can be easily made in an ordinary stove, as the copper, which must be first melted, fuses at a much higher temperature than brass. A very good formula for yellow brass is copper 70 parts, zinc 30 parts.

(42) J. A. C. asks how are the teeth put in the small bracket saws not larger than 1-16 inch wide. A. A number of steel plates having the thickness of the saws are clamped together and placed in a milling machine, which cuts teeth in the edges of the whole series of plates simultaneously. The saws are then sheared from the edges of the plates, and the plates are again milled, and so on.

(43) G. D. R. writes: On page 69, current volume, SCIENTIFIC AMERICAN, I find an article by G. F. Becker, entitled "Crystallization in Canada Balsam." I have frequently observed the figures assumed by balsam or Damar varnish, when boiled between slips of glass; and they are like the cut in the article referred to. If the gum is thick enough and allowed to cool under pressure, the figures are permanent. I am not prepared to dispute or discuss anything; but unless I was sure the glass in question had not been exposed to a "prairie fire" or some other source of heat, I should say heat was the cause of the figures instead of crystallization, as a heat sufficient to boil balsam will not char wood, or if carefully applied, scorch varnish. My proposition can be easily demonstrated by any one with a drop of balsam and two small pieces of window glass.

(44) B. T. F. writes: In SCIENTIFIC AMERICAN, February 7, 1880, page 91, article 4, C. M. K. asks: What will drive away or destroy fleas? I reply: Persian insect powder. I tried it and got rid of the terrible pest.

(45) G. H. writes: Having discovered traces of silver in several places upon large tracts of land we own in this region, we should like to have some simple method of testing or assaying specimens of the rock. From tests made in the East of several different specimens, we are led to believe the stuff will yield from $35 to $40 a ton, but wish to try this ourselves. Can you tell us of any simple apparatus? A. Charge into a 6-ounce crucible (a Battersea F answers very well) 1 ounce each of the ore and dry bicarbonate of soda, 2 ounces of litharge (free from silver), ½ ounce of argal, and cover with ½ inch of dry salt. Heat the crucible until the contents are in a quiet state of fusion, remove from the fire, cool, break, and clean the lead button by pounding on an anvil. If the button weighs more than, say, half an ounce, scorify it down in a scorifying dish in an open muffle. Heat 1½ inch bone ash cupel in the muffle, drop into it the button, and keep up the temperature of the muffle to a bright red heat until all the lead has been scorified off and absorbed by the cupel, and the small bead of gold or silver (if the ore contains any) becomes well rounded and clear. The ore must be finely powdered, and the whole of it passed through an eighty-mesh sieve.

(46) E. B. L. asks: How to cut up and work into shape retort carbon. It is very hard, and will turn the edge of everything I have tried. A. It is worked in the same manner as glass or stone. To saw it use a revolving disk of thin sheet iron or copper supplied plentifully with emery and water. To shape it, use an iron lap supplied with sharp sand or emery and water.

(47) G. W. W. asks how can I drill through stone or earthenware vases holes, ¼ in. say, to ½ in. diameter? The vases are about ¼ in. thick. A. Use a copper tube for a drill, and supply it with emery and oil.

(48) W. H. P. asks: Who was the first man who had knowledge of the existence of the American continent? A. Seeing that the most ancient vestiges of man thus far discovered have been found on this continent in formations antedating a portion, if not the whole, of the Glacial Period, history may be pardoned for not recording the first comer's name. The first white man certainly known to have visited our continent was Leif Ericsson, in the year 1001. There are traditions of earlier voyages of Europeans to America, but the historical evidence of such visits is insufficient.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending January 20, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air, apparatus for separating the water of condensation from compressed, S. B. Hunt .... 223,[illegible]
Air, pneumatic apparatus for economizing compressed, S. B. Hunt .... 223,[illegible]
Album clasp, S. Posen .... 223,[illegible]
Animal trap, K. Raby, Jr. .... 223,[illegible]
Animal trap, A. G. Rogers .... 223,[illegible]
Balcony, portable, H. H. De Wolf .... 223,[illegible]
Bale tie, cotton, W. D. Field .... 223,[illegible]
Bed canopy frame, W. W. Whitehead .... 223,[illegible]
Bedstead, cabinet, J. W. Staston .... 223,[illegible]
Blind slat fastening, Robinson & Sunderlin .... 223,[illegible]
Boiler furnace, steam, H. Cowell .... 223,[illegible]
Book binding, J. J. Hanlon .... 223,[illegible]
Boot and shoe edge burnishing machine, H. D. Stone .... 223,[illegible]
Boot and shoe sole, Darute & Dion 223,712
Boot, rubber, G. Watkinson .... 223,[illegible]
Boot treeing machine, J. K. Crisp (r) 9,066
Bow and arrow rack, E. T. Church .... 223,[illegible]
Bracelet, W. C. Edge .... 223,[illegible]
Boiler furnace, L. B. Parks .... 223,[illegible]
Burial casket, J. Taylor .... 223,[illegible]
Butter worker, J. Sattison .... 223,[illegible]
Camphor, apparatus for refining, W. V. McKenzie .... 223,[illegible]
Cane handle, telescopic, Chandley & Wilson .... 223,[illegible]
Car coupling, E. J. Clark .... 223,[illegible]
Car coupling, H. E. Henwood .... 223,[illegible]
Car coupling, B. Shafer .... 223,[illegible]
Car coupling, C. G. Waldling .... 223,[illegible]
Car door fastening, Buser & Shaw .... 223,[illegible]
Cars, ventilating and refrigerating, J. B. Elliot .... 223,[illegible]
Carbureting apparatus, D. P. Sanders .... 223,[illegible]
Caster, furniture, C. J. Brackebush .... 223,[illegible]
Chain, drive, L. W. Stockwell .... 223,[illegible]
Check rower, E. A. Morphew .... 223,[illegible]
Churn, G. H. Nabinger .... 223,[illegible]
Churn and butter worker, combined, E. Williams .... 223,[illegible]
Churn dasher, J. K. Finley .... 223,[illegible], 223,[illegible]
Churn operating device, J. B. Bolinger 223,700
Cigar light, E. L. Bryant 223,704
Clock movement, A. E. Hotchkiss .... 223,[illegible]
Clothes pounder, H. Howell .... 223,[illegible]
Cornice, adjustable window, W. W. Bolles .... 223,[illegible]
Cotton gin, W. L. Ellis .... 223,[illegible]
Cultivator, J. J. Deal .... 223,[illegible]
Cultivator, comb'd riding and walking, J. Pierpont .... 223,[illegible]
Cultivator teeth, coupling joint for, D. C. Owen .... 223,[illegible]
Currycomb, M. Sweet .... 223,[illegible]
Door plates, making, B. D. Kramer .... 223,[illegible]
Drum, heating, W. C. Doddridge .... 223,[illegible]
Exercising machine, G. Duplessis .... 223,[illegible]
Felt fabrics, manufacture of wool, E. Belknap .... 223,[illegible]
Fence, barb, Walsh & Dutot .... 223,[illegible]
Fence post, H. M. Beecher .... 223,[illegible]
Fifth wheel, J. Wampach .... 223,[illegible]
Filtering apparatus, M. Lansburgh .... 223,[illegible]
Firearm lock, W. W. Wetmore .... 223,[illegible]
Firearm, magazine, W. Trabue .... 223,[illegible]
Firearm, revolving, P. A. Holter .... 223,[illegible]
Fish, preserving, H. Sellman et al .... 223,[illegible]
Flame regulating device, F. Kosewitz .... 223,[illegible]
Flour mill dust separator, G. T. Smith .... 223,[illegible]
Fruit gatherer, J. P. Biddleman 223,720
Gelatine for vitrifiable prints, preparation of, E. Salvy .... 223,[illegible]
Glass working machinery for handling blow pipes in, R. Gray .... 223,[illegible]
Glassware, manufacture of, J. M. A. Doherrypon .... 223,[illegible]
Grain binder, W. M. Platt .... 223,[illegible]
Grain binder, D. Strunk .... 223,[illegible]
Grain meter, W. H. Allen .... 223,[illegible]
Grate, J. Collins .... 223,[illegible]
Grinding and polishing implement, T. B. Stone .... 223,[illegible]
Harness breeching stay, M. M. Sulgrove .... 223,[illegible]
Horse rake and hay spreader, G. S. Palmer (r) .... 9,0[illegible]
Horseshoe, D. Hudson .... 223,[illegible]
Hydraulic motor, Class & Bringleb .... 223,[illegible]
Hydraulic press, J. Watson .... 223,[illegible]
Ice cream freezer, C. W. Packer .... 223,[illegible]
Ice cream freezer, T. Scantlin .... 223,[illegible]
Inhaler, nasal, J. H. Yates .... 223,[illegible]
Iron and steel, manufacture of, J. Reese .... 223,[illegible]
Jeweler's clamp, A. A. Cowing .... 223,[illegible]
Journal box, anti-friction, E. D. Draper .... 223,[illegible]
Knitting machines, needle cylinder or bed of, S. Crandell .... 223,[illegible]
Lamp, electric, F. Winters, Jr. .... 223,[illegible]
Lamp regulator, electric, Houston & Thomson .... 223,[illegible]
Lathe feed mechanism, J. Houck .... 223,[illegible]
Lens, optical, L. Allen .... 223,[illegible]
Lock, F. Juhl .... 223,[illegible]
Locomotives, tramway and other, J. Matthews .... 223,[illegible]
Loom, J. Lyall (r) .... 9,0[illegible]
Magneto-electric machines, armature and commutator for, Thomson & Houston .... 223,[illegible]
Magneto-electric machines, automatic adjuster for commutator brushes on, Thomson & Houston .... 223,[illegible]
Marine transshipment and overland transportation, A. Toelmer .... 223,[illegible]
Measuring machine, cloth, O. W. Dolan .... 223,[illegible]
Milk cooler, D. Van Hovenberg .... 223,[illegible]
Mill for reducing, levigating, etc., L. Smith .... 223,[illegible]
Mower, lawn, J. H. Olcott .... 223,[illegible]
Music sheets, apparatus for cutting pattern plates to be used in making perforated, G. B. Kelly .... 223,[illegible]
Musical instruments, making perforated sheets for mechanical, G. B. Kelly .... 223,[illegible]
Neck band shaper, W. H. H. Tracy .... 223,[illegible]
Packages, apparatus for expelling substances from, W. H. Masy, Jr. .... 223,[illegible]
Pantaloons holder, J. F. & T. Reinhardt .... 223,[illegible]
Paper cutting machine, Levinson & Vanhorn (r) .... 9,0[illegible]
Paper cutting machine, A. Malm .... 223,[illegible]
Paper feeding machine, F. H. Lauten .... 223,[illegible]
Paper, making paneled, Sipe & Rogers .... 223,[illegible]
Paper pulp from wood, etc., making, W. E. Farrell .... 223,[illegible]
Partition, wooden, F. G. Himpler .... 223,[illegible]
Pen, movable cattle, D. Harrington .... 223,[illegible]
Pen, stylographic fountain, Hawkes & Madeheim .... 223,[illegible]
Pens, fountain attachment for writing, T. Williams .... 223,[illegible]
Plastered wall, A. H. Becker .... 223,[illegible]
Plow, A. G. Christman .... 223,[illegible]
Plow, J. H. Chase .... 223,[illegible]
Plow point, J. Oliver .... 223,[illegible]
Portable and road engine, B. Yoch (r) .... 9,0[illegible]
Porte monnaie, G. C. G. Williamson .... 223,[illegible]
Preserving grapes, etc., apparatus for, C. J. Rena .... 223,[illegible]
Pulley block sheave, C. H. Hadley .... 223,[illegible]
Pump, H. R. Baker .... 223,[illegible]
Pump, rotary, J. M. Taylor .... 223,[illegible]
Pumping engine, N. W. Wheeler .... 223,[illegible]
Punching machine, gunpowder, T. Shaw .... 223,[illegible]
Quartz, etc., method of and apparatus for pulverizing and separating metalliferous, S. F. Hodge (r) .... 9,0[illegible]
Quartz mill feeder, T. A. Cochrane (r) .... 9,0[illegible]
Railway head, C. W. Anderson .... 223,[illegible]
Refrigerator, D. C. Sanford .... 223,[illegible]
Roof, composition, T. Fugate .... 223,[illegible]
Rotary engine, J. A. Adams .... 223,[illegible]
Saddle box loop, harness, O. Rosencrans .... 223,[illegible]
Sausage stuffer, A. Diffenderfer .... 223,[illegible]
Scale beam, H. Willard .... 223,[illegible]
Screws or bolts, machine for rolling threads of, H. A. Harvey .... 223,[illegible]
Sewing machine and trimming device therefor, J. E. Wiggins (r) .... 9,0[illegible]
Sewing machine button hole attachment, C. M. Banks .... 223,[illegible]
Sewing machines, clutching and breaking device for power driven, L. Sternberger .... 223,[illegible]
Shearing horses, device for, F. T. Wolseley .... 223,[illegible]
Sidewalk, D. Watson .... 223,[illegible]
Sign, H. J. Blowney .... 223,[illegible]
Slate frame, noiseless, W. S. Davis .... 223,[illegible]
Spinning machine, T. Mitchell .... 223,[illegible]
Spinning machine, ring, Howland & Lawton .... 223,[illegible]
Spinning spindle bolster, H. Gillman .... 223,[illegible]
Square, framing, M. B. Cornell .... 223,[illegible]
Square, protractor, etc., combined, S. D. Halley .... 223,[illegible]
Steam and hot air pipes covering, A. B. Battelle .... 223,[illegible]
Steam engine reversing gear, W. Baxter .... 223,[illegible]
Steel, tempering, J. C. Jenkins .... 223,[illegible]
Stirrup, H. D. Adel .... 223,[illegible]
Stone crusher, T. A. Blake .... 223,[illegible]
Stone or marble, making artificial, W. H. Hooper .... 223,[illegible]
Straw cutter, D. A. Walker .... 223,[illegible]
Suspenders, M. Altmann .... 224,[illegible]
Switch and signal connections, foundation for, C. H. Jackson .... 223,[illegible]
Telephone, voltaic transmitting, A. K. Eaton .... 223,[illegible]
Thill coupling, C. Worthen .... 223,[illegible]
Thill couplings, anti-rattler for, J. S. Healey .... 223,[illegible]
Tin and other metal ware, bottom for, J. K. Finley .... 223,[illegible]
Tobacco pipe, S. T. Bacon .... 223,[illegible]
Tongue support, vehicle, O. Hebert .... 223,[illegible]
Toy, G. W. Ebright .... 223,[illegible]
Trace fastener, M. M. Bowlus .... 223,[illegible]
Trimming, W. Walker .... 223,[illegible]
Triturating mill, J. H. Mitchell .... 223,[illegible]
Valve, globe or check, J. S. Munger .... 223,[illegible]
Valve, steam engine slide, G. W. Anderson .... 223,[illegible]
Vegetable crusher, H. Adams .... 223,[illegible]
Velocipede, A. M. Allen .... 223,[illegible]
Ventilating and cooling dairies, J. Wilkinson (r) .... 9,0[illegible]
Ventilating apparatus, W. F. Thiers .... 223,[illegible]
Wagon brake, automatic, W. P. Wood .... 223,[illegible]
Washboard, E. A. Kitzmiller .... 223,[illegible]
Washing machine, G. W. Dorris .... 223,[illegible]
Washing machine, F. Hamblin .... 223,[illegible]
Whiffletree guard, W. I. Marsh .... 223,[illegible]
Whisk, H. Bradt .... 223,[illegible]
Windmill, S. B. Goff .... 223,[illegible]
Wire, etc., machine for polishing, S. P. M. Tasker .... 223,[illegible]
Wooden rods, polishing round, C. Kirk .... 223,[illegible]

DESIGNS.

Carpet, A. Heald .... 11,[illegible] to 11,[illegible]
Carpet, D. McNair .... 11,[illegible]
Carpet, T. J. Stearns .... 11,[illegible]
Carpet, P. Tetrel .... 11,[illegible]
Key bow, F. W. Mix .... 11,[illegible]
Spoon or fork handles, A. Hart .... 11,[illegible]

TRADE MARKS.

Cotton fabrics, unbleached, bleached, and colored, woven, Hill Manufacturing Company .... 7,[illegible], 7,[illegible]
Flour, wheat, Empire Mill Company .... 7,[illegible]
Throat and lung diseases, remedy for, Lawrence & Martin .... 7,[illegible]
Woolen goods, such as cassimeres, suitings, etc., E. Oelbermann .... 7,[illegible]

English Patents Issued to Americans.

From January 16 to January 20, inclusive

Car starters, J. Hill, Williamsport, Pa.
Elevator, hydraulic, C. W. Baldwin, Brooklyn, N. Y.
Gas regulator, M. G. Wilder, Brooklyn, N. Y.
Paper, compound for, R. A. Fisher, Philadelphia, Pa.
Paper, manufacture of, R. A. Fisher, Philadelphia, Pa.
Paraffin, refining, W. Bell, New York city.
Photo relief engraving, G. C. Bell, Brooklyn, N. Y.
Puddling furnace, W. Stubblebine, Bethlehem, Pa.
Railroad rails, manuf. of, G. Webb, Johnstown, Pa.
Steam boiler, heating appt., J. Evans, Philadelphia, Pa.
Steel, treatment of, G. Webb, Johnstown, Pa.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

1880. 1880. 1880.

The Scientific American

FOR 1880.

THIRTY-FIFTH YEAR.

VOLUME XLII. NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Third day of January, 1880, a new volume was commenced. It will continue to be the aim of the publishers to render the contents of the new volume as attractive and useful as any of its predecessors.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4 gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

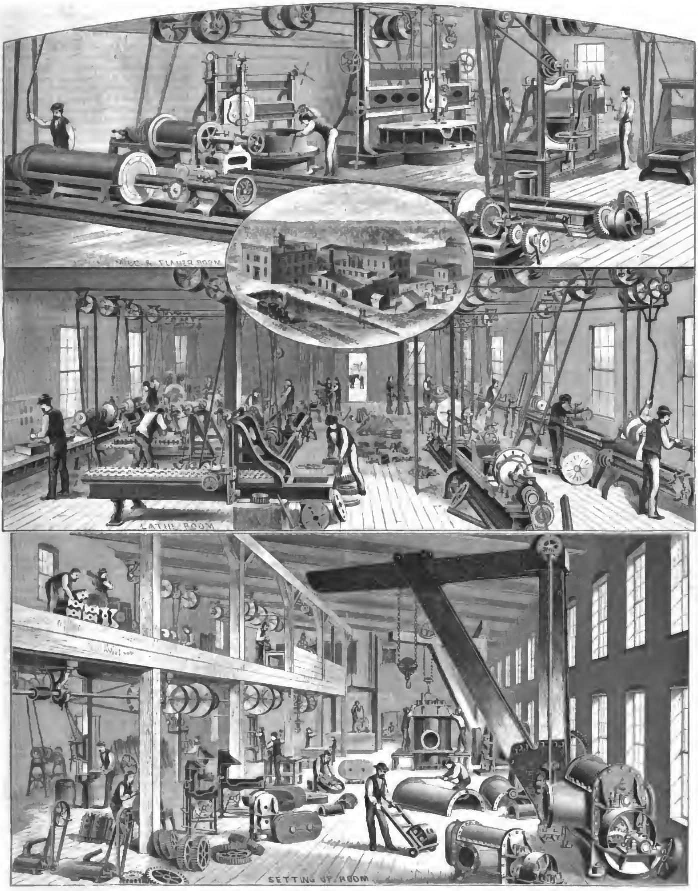
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Phila. ... Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII. No. 9. [NEW SERIES.] | NEW YORK, FEBRUARY 28, 1880. | [$3.20 per Annum. [POSTAGE PREPAID.]



THE MANUFACTURE OF ROTARY PRESSURE BLOWERS.—WORKS OF P. H. & F. M. ROOTS, CONNERSVILLE, IND.—[See page 130.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, FEBRUARY 28, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 217.

For the Week ending February 28, 1880.

Price 10 cents. For sale by all newsdealers.

PASSAGE BY THE HOUSE OF REPRESENTATIVES OF A LAW FOR THE ENCOURAGEMENT OF SWINDLING.

In the SCIENTIFIC AMERICAN of January 3, and again January 17, the injustice and mischievous tendency of certain bills for the protection of such as purchase patented articles and processes from parties unauthorized to sell, were pointed out and discussed at considerable length. The bills referred to are still with the House Committee on Patents.

Meantime bills of similar purport have been introduced and referred to the Committee on the Revision of the Laws, which appears to have been more favorably disposed toward schemes of that nature. At any rate the bill approved by this committee (H. R. No. 4419, introduced as a substitute for House bill 3767), covers the same ground as the bills of Messrs. Baker, Colerick, and others above referred to, in providing that "hereafter in any suit in any court having jurisdiction in patent cases for an alleged use or infringement of any patented article, device, process, invention, or discovery, where it shall appear that the defendant in such suit purchased the same in good faith for his own personal use from the manufacturer thereof, or from a person or firm engaged in the open sale or practical application thereof, and applied the same for and to his own use and not for sale, if the plaintiff shall recover a judgment for $5 or less as damages the court shall adjudge that he pay all costs of suit; and if the plaintiff shall not recover the sum of $20 or over the court shall adjudge him to pay all his own costs, unless it shall also appear that the defendant at the time of such purchase or practical application had knowledge or actual notice of the existence of such patent; provided that nothing contained herein shall apply to articles manufactured outside of the United States."

On February 9 Mr. Thomas, of Illinois, moved to suspend the rules and discharge the committee from the further consideration of the bill quoted, and that the bill be passed; which was done without discussion.

The alleged object of this bill is to keep farmers from being swindled by sharpers who, fraudulently pretending to own patent rights, offer to sell what they have no power to deliver, thereby making the unwary buyers liable to suits for infringement when the rightful owners of the patents come along.

It is said that actual owners of patent rights have sometimes entered into conspiracy with such swindlers, the one selling without right, the other following and collecting a second payment. Speaking of the proposed law as a remedy for such practices, the New York *Herald* says:

"Nothing but such a law—unless it be a properly handled shotgun—will dispose of the numerous sharpers that have played into each other's hands so successfully that many people, particularly farmers, are afraid to purchase patented articles of any kind. No citizen who is not a special student of Patent Office records can be expected to know anything about infringements or how to guard himself against them; therefore the power which makes the right of a patentee absolute should defend honest purchasers. A better method of defense could hardly be devised than the bill that is now awaiting further action, for the profits of sharp practice would be brought down to nothing if the wily prosecutors were compelled to pay the costs."

It is safe to say that no honest patentee would object to a law, however stringent, for the suppression of "sharpers" and "sharp practices" of the sort alleged. It is equally safe to say that the swindling practices so volubly described by the advocates of the proposed law are purely imaginary. They have no real existence—certainly not to anything like the extent pretended by those who make them a pretext for legislative interference with the property rights of patentees. We have yet to hear of the first well-authenticated case of the sort, and confidently challenge the friends of this bill to produce one. And even if there were such conspiracies, and they were as numerous as they are said to be, they would still fail to furnish any justification for this bill.

Years ago a similar swindle was practiced with horses. A man would ride into town with a handsome horse, which, on one pretext or another he would offer to sell for much less than the animal's real value. Some "innocent" buyer would pay the price and chuckle over his bargain. As soon as the seller could get well out of the way his confederate would appear in pursuit of the alleged stolen horse, prove his property, and ride on to divide the proceeds of the fraudulent sale, and repeat the trick. For a time this sort of business was a paying one. It was ultimately broken up, not by a law making purchase in good faith a bar to the rightful owner's claims, but by compelling purchasers of stolen animals to surrender them and look to the thief for the return of the money. It did not take long for men to discover the impolicy of buying horses without plentiful evidence of the seller's right to sell. Suppose that, instead of letting the evil correct itself in this legitimate way, a special law after the model of this bill had been passed; would anybody have been benefited except horse thieves and dealers in stolen horses?

In like manner, who but infringers and those who wish to use inventions without paying the inventor's royalty, would be benefited by the law proposed in this bill? To forestall a few swindlers and protect their innocent victims, is put forth as a pretext for the wholesale invasion of inventors' rights; the real purpose of the bill is as clear as the motives of the wolves in the fable, when they volunteered to stand guard over the lambs.

The great majority of patent rights rest upon inventions the products of which are individually of small cost, though of great utility and practical value. In many cases an infringer can produce and put upon the market such articles under conditions which make it next to impossible for the rightful manufacturer under the patent to find him out. The manufacturer's only recourse then is to spoil the market for such fraudulent goods by proceeding against their users. This reasonable protection is barred him by the proposed law, which makes him pay all the costs of suit, however culpable the defendant may be, when the damages do not exceed $5; and his own costs, when the damages are less than $20, except when he is able to prove that the infringer actually knew he was infringing.

Such a law substantially says to intending purchasers: "Go on; the chances are all in your favor. Buy anything that is offered without question. Ignorance is innocence. It will cost the patentee a great deal more to sue than he can get from you in damages, even if he succeeds, and the probabilities are that he will not bring suit with such heavy odds against him."

With a safe market thus made for his goods, the infringer need have no fear of success, so long as he skillfully covers his tracks.

Meanwhile the inventor, we suppose, is expected to toil on patiently, inventing for the fun of it, or because he cannot help himself; and to continue to take out patents which he can defend in the courts if he has money enough to pay his opponent's lawyers as well as his own.

Fortunately the Senate will have a word to say about such proceedings, and it is to be hoped that the friends of inventors and of just laws will lose no time in presenting the facts of this case to their senators in such a manner as may prevent in the Senate a repetition of the hasty action of the House.

The argument that people cannot be expected to know anything about patent infringements, and therefore should be protected in their unwarranted purchases of patented articles and processes, is pure childishness. No man can be expected to know the owner of every horse in the United States; but he can be and is expected to find out whether the would-be seller of any horse he wants to buy has a legal right to sell. If he does not take that trouble, the risk should be his and not that of the real owner, in case the horse has been stolen.

No man can be expected to know all the bonds and other papers of value that have been lost or stolen; but every man is expected not to buy such property without a sufficient guarantee that the seller came honestly thereby. To pass a law shielding men from loss in case they violate this plain rule of trade would simply put stolen bonds on the same footing in the markets as honest property, and remove the chief disadvantage which burglars and pickpockets labor under. They would heartily approve of such a law, no doubt, and so would all dealers in stolen property; but how would it suit the honest owners of financial paper?

If such a law would favor the dishonest and react injuriously upon the honest when applied to horses, or bonds, or any other form of property liable to be misappropriated, it would be not less unjust and mischievous when applied to patent rights.

Besides, the proposed law is open to the objection of being unnecessary. If we mistake not, there are already in force laws against conspiracy to defraud, whether the means employed are patent rights or anything else, quite sufficient to deal with the swindlers whose operations furnish a pretext for a new law. There would, however, be no occasion even to appeal to such laws, if men would simply learn not to buy anything from unknown and irresponsible parties.

But, as we have intimated again and again, the ostensible object of this bill is not its real object. Its actual purpose is so to hamper the patentee in the defense of his rights as to make it impossible for him to sustain them in connection with any article of small cost and general utility that farmers and others wish to use without payment of royalty.

In addition to its needlessness and injustice, the law proposed is open to the serious objection that it is a special law, designed to affect a limited range of persons and cases. If we must have a law of the kind, let it be a general law, applicable to all departments of trade. Such a law might run somewhat as follows:

"Hereafter, in any suit brought in any court for the collection of lawful debts, or for the recovery of the value of goods sold, or for the recovery of damages for the felonious procurement, possession, or use of any description of property unlawfully held or used by another, if the plaintiff shall not recover a judgment for $5 or less, the court shall adjudge that he pay all the costs of the suit, and if the plaintiff shall not recover the sum of $20 or over, the court shall adjudge him to pay all his own costs; provided that nothing contained herein shall apply to articles manufactured outside the United States."

It is respectfully suggested that the foregoing, or something of like effect, be submitted as a substitute for, or amendment of, the more limited bill (H. R. No. 4,419), which has come up to the Senate for consideration.

FLOUR VS. BRAN.

At a recent meeting of the National Association of British and Irish Millers held in London, a most interesting discussion took place relative to the comparative merits of what was styled the "old school" system of making flour and the new methods now being so largely adopted. There was a large attendance of the leading millers of the United King-

dom, and the milling industry of England, which has heretofore been conspicuous for its slow-going conservative qualities, seems at last to have awakened to the fact that "flour is manufactured of a highly superior quality by other nations," which is finding its way there "in quantities that threaten to exercise a depressing influence" upon their business.

It was generally conceded that the idea of the "brown bread" school, that flour was more nutritious when it contained a portion of the bran, was erroneous, for while the bran might have, in some cases, a beneficial effect medicinally as a laxative, it lessened the nutritive power of flour in the exact proportion in which it was present. How, then, to make the best flour—how best to "divide the flour portions of the wheat berry as completely and distinctly as possible from the offal"—is the question which the English millers find foreign competition now forces them to give more attention to. The different methods of milling were compared, and various arguments urged as to their relative merits, but the principal question seemed to be as to the advisability of substituting milling by rollers made of chilled cast iron, for the old way of grinding by millstones, either wholly or partially. Many other points were discussed, but the principal interest of the meeting centered around this one question. Diagrams were shown upon the wall of the hall where the meeting was held illustrating the roller mill, which squeezes flat the kernels of wheat, from which the flour bursts out, without spoiling the bran, while it was claimed that heavy millstones operated more by friction than by pressure, tearing, rubbing, and fretting the grain, giving, even with the greatest care, a large mixture of bran dust with the flour, and so fine that it could never afterward be thoroughly separated from it. Notwithstanding there were many millers present who had large amounts of money invested in the making of flour by the old millstone process, and there was an evident reluctance to acknowledge the great superiority of the flour milled by rollers, numerous specimens of each of which were presented for examination, the general sentiment seemed to be in favor of the adoption of the new process, although there were many who manifested a disposition to oppose it step by step, and who will only give way as the better brands of flour, with the smallest proportion of bran and woody substance, drive out the inferior grades.

The thorough cleaning of the wheat before milling was also put forward as a most important essential in the making of the highest grade of flour, and for this purpose the American Brush machine was highly spoken of. One speaker said that the American theory was that a light cleaning was sufficient, which he thought was not correct, "as it is by no means a light treatment which the wheat is subjected to in passing between the stones in the operation of grinding." Therefore, he argued, "as much of the outside of the wheat as can be proved by examination of the bran is at present ground off by millstones should, if possible, be removed while it can be kept by itself," and one of the wants of the future in the milling business was a machine which would make the outside of the wheat, before passing through the stones, resemble the outside of the bran as it now comes from the stones. This, it was claimed, would prevent a good deal of bran dust from becoming a part of the flour, and tend to the making of that perfect article when all the flour might be put into one sack and the offal into another, or "the complete separation of every particle of flour from every particle of the other constituents of the wheat."

The American International Exhibition of Milling Machinery and Mill Products, to be held at Cincinnati, in June next, in connection with the annual fair of that city, was referred to at length by several of the speakers, and the hope was expressed that there would be general participation, especially as arrangements had been made whereby machinery might be entered for exhibition without any payment of duties.

A NEW GOVERNMENT BUREAU PROPOSED.

A bill to create a Department of Manufactures, Mechanics, and Mines has been introduced in the House of Representatives. The duty prescribed for the new bureau is to collect information concerning the manufacturing, mechanical, and mining industries of the country; to secure information as to the condition of the producing classes, especially as to their wages and cost of living as compared with the value of their productions, and to investigate the moral, social, educational, and sanitary condition of mechanics and laborers, and as to the causes that may operate injudiciously upon these conditions; to collect statistics of the leading manufactures of the several States, the amount of capital invested, value of raw material used, wages paid, value of produce, and number of persons employed; also, to secure information as to the location of the mineral lands, the number of persons employed, and quantities of minerals produced. The department is to be under a commissioner of manufactures, mechanics, and mines, to be appointed by the President for four years, upon a salary of $4,000, with a chief clerk, upon a salary of $2,500 per annum, and as many clerks as may be necessary, at salaries in no case exceeding $1,800 per annum.

Wisely planned and administered such a department might be of great benefit to the industries of the country, and would furnish a proper complement to the Departments of Education and Agriculture, also assuming them to be wisely administered. In a country like ours, education, agriculture, manufactures, and mining involve interests of infinitely greater importance than those which fall under the jurisdiction of the Army and Navy Departments. And, though it is no part of the business of the government to interfere in either of these great lines of individual effort—and such interference should not be tolerated—it is still possible for a central bureau to be of great service in collecting and disseminating exact information with respect to their condition and needs.

There is a serious risk, however, that the new bureau might be anything but beneficial. In the hands of an incompetent commissioner it might simply pile up antiquated, inaccurate, and useless statistics, as has been done to a wearisome extent by the Commissioners of Education and Agriculture, especially the former, or it might fall into worse hands and be wholly prostituted to partisan ends. Besides the educational, moral, social, and sanitary condition of mechanics and laborers is no more in need of official investigation than the corresponding condition of merchants, lawyers, clergymen, politicians, or any other portions of the community. The ill success of the late Labor Committee, in its efforts to gather information with regard to the industrial affairs of the country, illustrates only too clearly the probable value of the information which the proposed department would collect when administered for partisan purposes.

On the other hand, it is quite conceivable that the new bureau might be, in each and all of the several fields of inquiry prescribed for it, as successful as the Massachusetts Labor Bureau has been in investigating the industrial interests of that State. In such case its benefits would be incalculable.

THE PREVENTION OF FIRES.

There is nothing which can be said under this head which does not receive the close attention of all officers of fire insurance companies. They have the most direct and powerful motives to impel them to obtain and publish every scrap of information which will in any way tend to make fires less frequent, and will lessen their destructiveness when they do occur. The fire insurance companies now control such a vast amount of capital, and have such an army of experts in their employ, that there is very little which is presented in their line that does not meet with the most exhaustive examination, and the rates charged on risks are varied according to their judgment as formed on many and widely different grounds. The mutual system of insurance, started among the cotton goods manufacturers of the Eastern States in 1835, first gave the great impetus to this method of particular discrimination, as, where every one insured was thereby made to a proportionate extent his own insurer, and correspondingly interested in the safety of all other property in the same company, there was every motive to see that all possible provision should be made against loss by fire, and each risk should be closely valued.

Among the subjects which have particularly engaged the attention of the mutual companies, and in regard to which all the other companies quickly followed their example, were the building, arrangement, and location of buildings to be used for factory purposes. A leading president of a mutual insurance company in Boston the other day remarked that every one now knew in what a model factory consisted, so far as the question of insurance was concerned; the floor beams must be far apart, instead of close together, and covered with three inch plank for flooring; where the beams were let into the wall they must be rounded on the top corner and the bricks laid on loose, so that in case of fire they would drop out without pulling the wall down; the roof must be nearly flat, and everything else in the general plan after such a calculation as would give the firemen ready access, in case of fire, to every part of the structure. In addition to this, such parts of the work as are supposed to be especially dangerous are often placed in separate buildings; the picker room in cotton factories is generally so provided for, and water pipes are so disposed as to make it comparatively easy to flood such apartments at an instant's notice. In tanneries and leather factories the bark grinding is generally done at a distance from where the drying lofts are, as well as from where the stocks of bark are stored, and so, with every industry, care is taken, as far as possible, to isolate those parts of the business in which fire would most readily happen, or where it would be most destructive if it did occur.

Another matter which has attracted considerable attention from the insurance companies has been the various kinds of hose in use for fire engines. Until a comparatively recent date nothing was considered quite as good as leather hose; but it may now be safely said, that while there is annually a great increase in the total amount of fire-hose used in the country, there is no increase in the amount of such hose manufactured from leather. With good care leather hose will probably outwear any other variety, but it requires a vast amount of attention, and some little amount of experience for a proper understanding of how it should be treated, while that made of rubber, or linen, or cotton, rubber lined, involves no such labor. Many varieties of the latter, also, will withstand a much higher pressure before bursting than leather can be successfully subjected to. At a trial which was made in December last, before some inspectors of a mutual fire insurance company, it was found that one sample of 6-ply cotton rubber-lined hose, weighing twenty ounces to the foot, withstood a pressure of over 1,100 pounds to the square inch, while similar hose weighing eight to twelve ounces to the foot withstood a pressure of from 300 to 500 pounds to the inch. The fact, however, that the officers of insurance companies, who are in a comparatively independent position, as related to the different manufacturers of hose, are taking the initiative in such trials, and have a strong interest in seeing that the best and most reliable article is everywhere employed, proves a great stimulus to the manufacturers, and has provoked a rivalry which cannot fail to be of benefit to the public generally.

CHASTANT'S OBSERVATIONS ON YELLOW FEVER.

Dr. Alcée Chastant, of New Orleans, takes strong ground against the germ theory of the origin of yellow fever. All investigations to discover the manner of its introduction into the large cities of Europe and the United States have failed, he says, with all the experience so far had, to establish definitely the real origin of the disease. Unless the microscope shall ultimately prove the contrary his opinion is that while the conditions which produce yellow fever can be known, the essential nature of its direct cause will ever remain a mystery. From a study of its geographical limits and its more or less irregular irruptions he thinks that its outbreaks must be some combination of meteorological and telluric conditions especially favorable to the development of the disease, such as a high temperature with dampness, conjointly with certain emanations from the earth.

Touching the character of the disease, Dr. Chastant's long experience warrants, he thinks, the opinion that each epidemic of yellow fever is of its own peculiar and special type, varying according to the locality and the influences which have been instrumental in bringing it about. The immediate cause of the disease is the introduction into the human organism of a specific inorganic poison, which has never been chemically or microscopically demonstrated, a poison which develops under the influence of heat, moisture, and other favorable circumstances.

"Yellow fever is not imported, but is most certainly endemic. When, however, climatic and telluric conditions concur, and foreign cases are existing, it then spreads and becomes epidemic." Such epidemics cannot be prevented, but can be mitigated by general sanitary measures and precautions. He agrees with the late Dr. Warren Stone, in regarding the disease to be non-contagious, but taken from the atmosphere poisoned by telluric emanations. The germ theory he regards as not only unproved, but highly improbable. On several occasions Dr. Chervin swallowed the matter of black vomit and suffered no harm. Neither did Dr. Guyon, at Martinique, from similar experiments. Dr. Firth inoculated dogs with the fresh matter, and subjected himself to the same operation. He applied the fluid to the surface of a cut made on his arm, and secured it there for two days by means of sticking plaster, and repeated the experiment above twenty times in various parts of his body. He inserted the matter in his eyes, and swallowed a large quantity of black vomit, pure and dilute, and no injurious effects ensued. Cats, dogs, and fowls were fed with it without sensible effects, and the fumes obtained by evaporating black vomit did not harm those who inhaled them. Such heroic experiments may not disprove the germ theory, but they certainly tell very strongly against it.

Sporadic cases of yellow fever, Dr. Chastant holds to be produced by natural causes, arising exclusively from the *eremacausis* which takes place in the filth of gutters, as well as on the immediate surface of the earth in certain localities, and these cases do not extend beyond the sphere of these causes. Although these natural causes, whenever they exist, help to increase the yellow fever, yet its epidemic feature arises from a more general law of the soil, the effect of which is produced by a geological *repercussive action*. Sporadic cases may precede an epidemic, but he doubts if they can produce an epidemic, unless there is a concurrence of both causes.

An Unexpected Comet.

A dispatch has been received from Dr. Gould, formerly of the Dudley Observatory, Albany, N. Y., but now director of the Cordoba Observatory, South America, stating that a great comet is in the neighborhood of the sun, passing northward. No large comet has been expected this year, and no small one at this season, Winnecke's comet not being due until near the end of this year. Reports by mail are awaited with great interest. Should Dr. Gould's dispatch be confirmed, a new member must be admitted to our cometary system; and possibly the nations north of the equator may also be treated to a sight of it.

Railroad Crossings.

Mr. James Torrance, of Troy, N. Y., proposes the following method of abolishing the danger attending the present style of railway crossings. He would use for such crossings a rail of special form, rolled in one piece of the usual length, with a groove wide enough for the flange of the car wheel to run in; the groove to be wedge-shaped and widest at the top, with plain sides, so as not to catch the feet of men or animals. In this way he would get rid of the usual trap between the planking and the rails. Such a grooved rail could easily be kept clear of snow and ice; and the extra cost of rolling would be nothing, he thinks, compared with its advantage in doing away with the risk to life and limb attending the present style of crossings.

A JOINT resolution appropriating $20,000 to enable the Commissioner of Fish and Fisheries to represent the United States at the International Fishery Exhibition to be held in Berlin next April, was adopted by the House of Representatives, February 4.

AMERICAN INDUSTRIES, No. 32.

ROTARY PRESSURE BLOWERS.

Our large engraving represents the extensive rotary blower manufactory of Messrs. P. H. & F. M. Roots, of Connersville, Ind. These gentlemen, as many of our readers are already aware, were pioneers in this branch of industry, and were the first to introduce in this country and in Europe a successful positive blast rotary blower.

In 1860, to test thoroughly the capacity and merits of the newly-invented blower, the Messrs. Roots built two blowers, capable of melting from six to eight tons of iron per hour. These blowers were the first that were built of sufficient size for large foundries. One was placed in the large works of Miles Greenwood, Esq., Cincinnati, and the other in the stove foundry of G. W. Ball, Esq., Covington, Ky., where they were in daily use for nearly two years before others were built, melting daily from eight to twelve tons of iron. The results of these tests more than realized the most sanguine expectations of the inventors, and received the highest commendations from all who witnessed their performance, both as to economy of power and fuel and the quality of iron and castings produced. These tests were considered satisfactory and sufficient to warrant making arrangements for the manufacture of the blowers. It was soon ascertained, however, that, in order to make their manufacture a success, special tools were required, and that the business should be made a specialty, in order to bring the blowers up to the standard of first class machines. As the inventors were already receiving many orders, they decided on commencing the manufacture themselves. They purchased a small machine shop and foundry in Connersville, which they immediately enlarged, and furnished with such special tools as it was found from time to time were required to perfect their construction and increase the turn out.

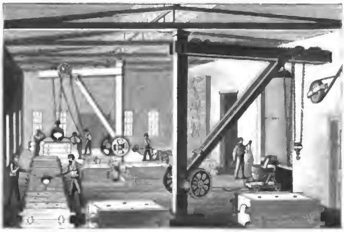
The manufacture of rotary pressure blowers was thus begun in 1863. From that date to 1873 to 1874 the works were frequently enlarged until over one hundred men were employed, and during this time orders for blowers were always in excess of the capacity of the works. The blowers were not only sold in all parts of the United States and Canada, but were sent to almost all parts of the world where machinery is used. The trade extended to the West Indies, Mexico, South America, the Sandwich Islands, Australia, the Cape of Good Hope, and elsewhere.

In Europe, patents were obtained in England and the principal countries on the continent, and arrangements were made for their manufacture in England, France, Belgium, Austria, and several places in Germany. There are already over three thousand of these blowers in use in England alone, and probably as many more on the continent, ranging in size from those capable of blowing a single blacksmith forge to those having sufficient capacity to ventilate the largest coal mines, discharging with ease 200,000 cubic feet of air per minute. They are used by such firms as the following, viz.: Sir William Armstrong & Co., Newcastle; Sir Joseph Whitworth & Co., Manchester; the Barrow Hematite Steel Co., Barrow-in-Furness; London and N. W. R. R. Co., Crewe; Messrs. Platt Bros., Oldham, and hundreds of others in England; and by Herr Krupp, at Essen, Prussia; William Hartmann & Zimmermann, Chemnitz, Saxony; Phenix Works, Ghent, Belgium; M. Sigle, Vienna, Austria; Messrs. Heilmann, Ducommun and Steinlin, Mulhouse, Alsace.

These blowers have been awarded prize medals by three International Exhibitions. At Paris, in 1867, they received the highest award given to machines of that class. At the Vienna Exhibition, Vienna, Austria, 1873, they were also awarded the highest medal for progress. At the Centennial Exhibition, held in Philadelphia, 1876, they again received the highest award for *design, workmanship, material,* and *efficiency.* They have also received numerous other medals and awards from the American Institute, New York, and from the Cincinnati Industrial Exhibition, Cincinnati, Ohio, and other exhibitions and State fairs, all of which were awarded to this blower on account of the excellence of the principles of its construction, its simplicity, and efficiency, before many of the constructive and mechanical improvements which have since been made were added, and without any of the improvements published for the first time in this article. The manufacturers justly claim that if its intrinsic excellence was so great as to merit the high awards under the circumstances mentioned, they are now much more entitled to them after the great improvements that have been made in their construction.

Some ten years since the Manhattan Gas Company, at the suggestion of Mr. Sebattan—then their chief engineer—ordered two of these machines of the largest size to be used as gas exhausters. They worked very successfully, and since that time the largest and best companies in the United States and Canada have adopted this style of exhauster. In common with all other iron manufactures, this business was seriously affected by the years of depression that followed the panic. But the works have been kept in constant operation, and have had a steady though comparatively small trade.

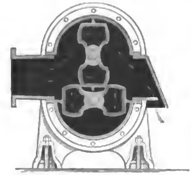
With the general revival of business this branch of industry has improved, and we are informed that to-day the Messrs. Roots have more orders than they can promptly fill, and are constantly increasing their force to meet the increased demand.



INTERIOR OF FOUNDRY.

The leisure afforded by the dull times has been improved to the utmost in perfecting all the constructive details of the blower, and bringing it up to the highest standard of mechanical perfection, till in these directions it seems impossible to make further improvements.

These improvements have simplified and reduced the number of parts of the blower, both external and internal. As now constructed, the internal operating parts of these blowers consist simply of two iron revolvers, each cast entire in one piece. There are no bolts, nuts, screws, washers, or other internal parts that can by any possibility get loose and require adjustment or cause injury. These revolvers are perfectly balanced, and this is a very important point, as they will bear much higher speed than unbalanced ones; for this reason a much smaller blower will do a given amount of work, and at a greatly reduced cost.



SECTION OF BLOWER.

The parts coming in contact and requiring to be finished have been reduced to less than a fourth of that required formerly, by which the friction of the parts passing each other has been greatly reduced, and iron revolvers can be made at much less cost. As no wood is used in the construction of the blower, all danger of shrinking or swelling of any of the parts is entirely obviated, and the parts can be made to run in close contact, and damp or dry, hot or cold air, or dust, can be passed through the blower without injury.

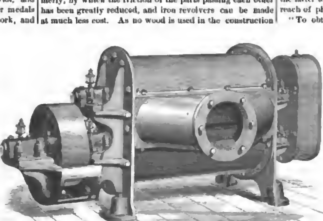
Externally the blower has been very much simplified and improved. Only two gears and one driving pulley are now used. The gears are cut in the most perfect manner, and are inclosed in iron housing and perfectly protected from dust and accident. The driving pulley has a large belt surface, and the blower can be driven under high pressure with a loose belt. The driving shaft is provided with a bearing outside the driving pulley, which is rigidly attached to the blower. This gives double bearing surface to the driving shaft, compensating for the stress of the belt. The shafts are of steel; the journal boxes are of the best known construction, and are so arranged that when the bearings, which are of phosphor or carbon bronze, are adjusted or renewed, the shafts will be brought exactly into their original position. The attachments are very easy and simple. As the speed is slow the blower can be run directly from the main line of shafting, dispensing with counter shafts, etc. As the discharge pipe comes out horizontally from the blower, one quarter turn will carry it in any direction.

We have been thus explicit in giving the history of the growth of this industry, as it is a notable example of the healthy development of a valuable invention. From a small beginning it has expanded until it is known all over the world.

The works, which are in many respects unlike anything else in this country, are well represented by the engravings. The small vignette in the larger engraving gives a view of the exterior of the works, while above it is represented the room where the blower cases are bored and fitted, and where much of the larger and heavier work is done. The shafts and revolvers are turned, and the gear wheels are bored and cut, in the department represented by the central figure. All of the finished parts are brought into the large room shown in the lower view, to be put together to form the completed machine. The small view on this page represents the interior of the foundry, and the improved blower is also represented on this page in perspective and in vertical transverse section.

It will be observed by an examination of the internal part of the blower, as shown in these engravings, that it does not operate at all on the principle of a fan, that is, by imparting momentum to the air by running at a great velocity, but by a regular displacement of the air at each revolution, whether it runs fast or slow. When the air enters the case at the opening for induction, and is closed in by the wings of the revolvers, it is absolutely confined, and positively forced forward until brought to the eduction pipe, where it must be discharged or the machine stop if perfectly tight, as there can be no backward escapement of the air after it once enters the case, the contact being kept up at all times in the center of the blower between the pistons or revolvers, thus preventing any escape of the air in that direction. The advantages of a positive blower of this kind will be readily admitted by any one competent to compare it with other forms.

Mr. S. S. Townsend, 6 Cortlandt street and 8 Dey street, is general agent for the manufacturers of these blowers. Wm. Cooke, of 6 Cortlandt street, and James Beggs & Co., 8 Dey street, New York City, are selling agents.



IMPROVED POSITIVE BLOWER.

Crystallized Chlorophyl.

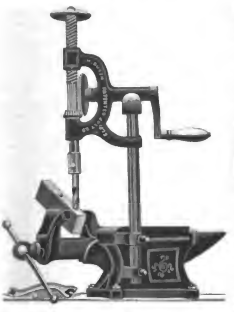
The following note by Mr. A. Gautier, on the method of obtaining pure crystallized chlorophyl, has been communicated to the Academy, and was read at a late meeting of the French Photographic Society, in consequence of its having been shown by MM. Becquerel, Cros, and Ducos du Hauron, that that substance, when added to a sensitive film, enabled the latter to reproduce colors hitherto considered out of the reach of photography:

"To obtain the chlorophyl I take the green leaves of spinach, cress, etc., and pound them in a mortar, adding to the pulp a little carbonate of soda until the liquid is neutralized, and then I submit the whole to strong pressure. The mass thus obtained I digest in alcohol of 55° C., and I again pass it through the press; then I digest it once more in alcohol of 85° C. By this process the chlorophyl is dissolved, along with all the fats, the wax, and the coloring matters. To separate these, the liquid is filtered, and then placed in contact with powdered animal charcoal previously well washed and raised to a high temperature. At the end of four or five days the liquid will be found to have turned a greenish or brownish yellow, and it will contain all the impurities. It is decanted off, and the charcoal is collected in a tube plugged with cotton wool, where it is washed with alcohol at 63° C. This liquid takes up the yellow crystallizable substance which is always found to accompany chlorophyl, and which seems to have some intimate relation with it. On the char-

coal thus deprived of the yellow substance, or containing mere traces of it, there is poured anhydrous ether, or, better still, light petroleum oil, which does not dissolve the yellow substance. Those solvents take up the chlorophyl, and yield a deep green liquid, from which the latter can be crystallized out by slow evaporation in the dark."

NEW VISE AND ANVIL DRILL.

We give herewith an engraving of a combination tool of great utility, made by the Miller's Falls Company, of Miller's Falls, Mass., and 74 Chambers street, New York city. With this tool the work can be held in the jaws of the vise in any desirable position, and a hole may be drilled either straight or at any required angle. It seems well adapted to the work of machinists and all other mechanics working in metals. It is fastened on a bench like an ordinary vise, as shown in the engraving. The drill press can be removed in an instant when the vise or anvil is wanted separately.



VISE AND ANVIL DRILL.

This combination tool is capable of a wide range of application in various kinds of iron and steel hand work. It is well made in all its parts, and only the best materials are used in its construction. The shaft to which the drill press is fastened and the spindle are both made of steel. Each machine is furnished with a chuck capable of holding drills from half an inch down.

A Supposed Unseen Outer Planet.

In a paper communicated lately to *La Nature*, M. Flammarion shows reason for supposing that probably a planet exterior to Neptune has been the determining cause of the orbit of the comet of 1862 (which has been surely determined), and describes its course round the sun, about the distance of the aphelion of this comet, and of the classical stream of meteors of the month of August. (It is known that Leverrier attributed to Uranus the introduction into our system of the stream of November meteors, and supposed the perturbation to have occurred in the year 126 of our era.)

ELECTRICAL PRESSURE INDICATOR.

The annexed engraving represents an improved pressure temperature indicator, designed to serve the very important office of indicating maximum and minimum pressures and temperatures. The importance of this class of inventions must be acknowledged by engineers, superintendents, and others who are required to give daily attention to these matters.

In all operations pertaining to the use of pressure or temperatures, there is generally some considerable range of pressure or temperature not in any way injurious; but extremes of high or low pressure or temperature are to be avoided for obvious reasons. If the pressure is too low, work is delayed and in some cases goods are injured. In either case loss will ensue; while, if the pressure run to the other extreme, it may reach a point where rupture must result. To avoid these extremes, the ordinary instruments indicating the pressures or temperatures are required to be carefully watched by the attendant, a duty that is sure to become wearisome in time, with a possibility of neglect at an important moment. Disaster is too often traceable to inattention of this kind.

The indicator shown in the engraving is a faithful servant, standing sleeplessly on guard day and night, ready to give warning when the extreme of either high or low pressure is approached by ringing a small bell placed in any room however distant, within hearing of the operator, thus enabling the attendant to perform other duties with an assurance that he will receive prompt notice of any considerable variation of pressure or temperature. When the device is to be used for indicating pressure it is attached to any of the ordinary spring pressure gauges, and when used to indicate temperatures it is connected with a pyrometer.

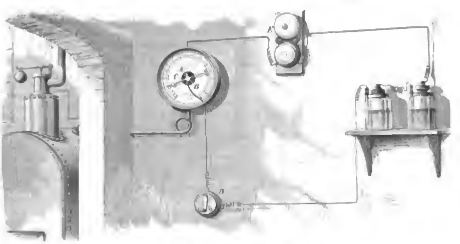
The device shown in Fig. 1 represents an ordinary spring pressure gauge, on the spindle of which is secured a crank arm, A, with a projecting crank pin on its outer end; the glass front of the gauge is bored for the reception of a post that has double washers on the opposite side of the glass to which pins, B and C, are attached. The washers turn upon a central screw in the post, enabling the pins, B and C, to be moved and secured to any desired position around the center of the post. A wire connects the central post with the batteries, passing in the circuit through a switch, D, and bell, E, back to the gauge.

The electrical circuit is completed or broken automatically by the rotation of crank arm, A, which coming into contact with the pin, C, completes the electric circuit, and rings the bell, E. This bell may be placed at any distance from the instrument, and will indicate the minimum pressure. A reverse movement of the spindle brings crank arm, A, into contact with pin, B, indicating the maximum pressure. An alarm at either extreme signifies that the attention of the attendant is now required. The switch, D, is provided to admit of disconnecting the electrical indicator whenever desired. This is found necessary when the device is used in connection with water tanks, reservoirs, etc., to prevent the bell ringing after the proper attention has been given.

In cases where it is desired to connect a number of boilers or tanks to one bell, a device not unlike a hotel annunciator is used (Fig. 2). The bell rings at the proper time, and the needle point shows the location of the boiler that requires attention.

SHAW'S PRESSURE ANNUNCIATOR.

This appliance is adapted to all kinds of spring gauges, and to Shaw's standard mercury gauges. The batteries employed are reliable, requiring only a little water to supply waste of evaporation once in the course of two or three months, and about once a year a few crystals of sal ammoniac are to be added.



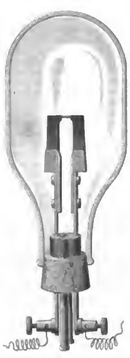
SHAW'S ELECTRICAL INDICATOR.

In large works the electric bell may be placed in the office or any part of the building, and will give instant notice if steam is too low to perform work, or so high that it is dangerous. The device seems capable of a great variety of applications, and will undoubtedly prove a watchful, faithful, and inexpensive servant.

For further particulars address the patentee, Mr. Thos. Shaw, at steam gauge warerooms, 915 Ridge Avenue, Philadelphia, Pa.

IMPROVED ELECTRIC LAMP.

We give herewith an engraving of an electric lamp patented by the well known electrical inventor, Mr. Moses G. Farmer, of Newport, R. I. A globe made of glass, and having an air-tight stopper fitted to its lower end, contains a small bar of carbon supported by two large blocks of the same material, mounted on the ends of two bars of metal extending downward through the stopper, and provided with binding posts for receiving the wires from an electrical generator. Two small tubes enter the globe through the stopper, for the purpose of substituting for the common air contained in the globe a vacuum or an atmosphere of some suitable gas. The small carbon rod offers great resistance to the passage of the electrical current, and is consequently heated to incandescence, and produces a brilliant light without consuming either itself or the gas contained in the globe.



FARMER'S ELECTRIC LAMP.

The Harnessing of Electricity.

Mr. W. H. Barlow, the new president of the Institution of Civil Engineers, London, in his recent inaugural address, speaking of the rapid growth of telegraphy and other practical applications of electricity, said that the diminution of power, from increased length of the conducting wire, had been surmounted by relays of power at fixed stations. (This was the discovery of Morse.) By employing this ingenious expedient on the Indo-European Telegraph, Calcutta had frequently been put in direct communication with London, a distance of 7,000 miles.

He further stated that Dr. C. W. Siemens had ascertained that, including all sources of loss, 50 per cent of the original power could be realized by electric wires at a distance of one mile from the motor; and that with adequate provisions against heating it would be no dearer to transmit electromotive power to a greater than to a smaller distance. Sir William Armstrong, by means of an electro machine and wire works his circular saw at a distance of a mile from the water wheel that turns the electric machine. By the same means Dr. Werner Siemens works a locomotive that carried thirty persons.

ENGINEERING INVENTIONS.

Mr. James A. Stout, of Belleville, Ill., has patented a traction engine in which the propelling power is applied directly to an adjustable front axle, and the axle is provided with a universal or ball joint motion. The boiler is of novel construction and designed with a view to economy and safety.

An improved rock drill, patented by Mr. John Brown, of Ishpeming, Mich., is so constructed that the piston and tool may be rotated by the entering air or steam, and that the entrance and exit of the air or steam will be controlled by the movements of the piston.

Mr. James E. Purdy, of Tallahassee, Fla., has patented a means for connecting cars, which is so constructed that the cars will couple themselves when run together, and will not be liable to become accidentally uncoupled.

Mr. James Morton, of Philadelphia, Pa., has patented

a hydraulic engine of peculiar construction for converting into mechanical power and motion the pressure of a column of water.

A wheel guard for railway cars, patented by Mr. Salomon Brisac, of New York city, is designed to prevent injury to persons who may accidentally fall in front of car wheels, and also to prevent the car wheels from coming in contact with obstructions on the track.

Mr. Orlando H. Jadwin, of New York city, has patented an improvement in the system of car propelling, in which an endless cable of wire rope is made to travel over a given route by the action of stationary engines, and the cars or other bodies are either connected to the cable to be drawn along by it, or are disconnected from it, by means of a clutch affixed to the car. The invention consists in this clutch or tension device, which is loosely connected with the car and formed of three principal parts—a pulley, a foot for holding the rope to the pulley, and a brake upon the opposite side of the pulley from the foot—these parts being arranged in such relation that a pressure of the brake upon the periphery of the pulley projects the pulley against the rope, and gradually clamps the same between the pulley and foot until the car attains the speed of the traveling cable.

Determination of Carbonic Acid in the Atmosphere.

The amount of carbonic acid in the atmosphere out-of-doors varies but little from day to day and from year to year. In-doors it is quite otherwise. In winter we close the windows to keep out the cold air, and in so doing prevent the exit of the impure air poisoned by combustion of coal in the stoves and oil in our lamps, as well as the exhaled effluvia of the breath. To determine the quantity of carbonic acid in a church, school, or theater is a guide in judging of the success or failure of its ventilation. The usual method consists in drawing a measured quantity of such air through baryta solution and weighing the precipitated carbonate.

Kapusstin has described a quicker and easier method, dependent upon the fact that 70 per cent alcohol will not dissolve carbonate of soda, while dilute alcohol will do so.

He dissolves ½ gramme of caustic soda in 1 liter of alcohol. He pours 75 c.c. of this solution into a 5 liter bottle full of the air to be tested, shakes it for half an hour, and pours it out, stirs it well, and draws off 25 c.c. of the turbid liquid. To this he adds water from a burette until the turbidity, due to undissolved carbonate of sodium, disappears, and multiplies the amount of the water by three. The following formula now gives the number of cubic centimeters (x) of carbonic acid at normal temperature and pressure contained in 5 liters of air, when n is the number of cubic centimeters of water necessary to dissolve the carbonate of sodium:

$$x = \frac{n - 6{\cdot}5}{0{\cdot}55}$$

This method is specially recommended for sanitary purposes, as the number of determinations made can be very large.

Oxalic Acid and its Salts.

BY DR. J. SCHNAUSS.

Oxalic acid is found pretty abundantly in the juices of plants in combination with calcium and potassium, and in the latter case in the form of acid salt of potassium. The juice of *Rumex acetosa*, *Oxalis acetosella*, and other similar plants, all contain this substance.

This acid oxalate of potassium is soluble with difficulty in cold water, on account of the property it possesses of dissolving ferrous salts almost to as great an extent as oxalic acid itself; it is used for removing ink and iron-mould spots. Oxalic acid can be prepared from this salt, as also from sugar, by oxidizing it with nitric acid. Of late years it has been obtained from sawdust, by heating that substance with sodium carbonate in the form of hydrous acicular crystals ($C_2H_2O_4+2H_2O$). It can be easily deprived of its water of crystallization, and this anhydrous acid is said to be capable of sublimation undecomposed; but if the hydrate be heated quickly in closed vessels it decomposes into carbonic oxide, carbonic anhydride, and formic acid. Heated with concentrated sulphuric acid (H_2SO_4) it separates into equal parts of carbonic acid gas and carbonic oxide.

In photography, oxalic acid is employed on account of its property of reducing the salts of the precious metals in the presence of light and heat, and also of readily dissolving the salts of iron, which are otherwise insoluble in water, even when in combination with a base. In the latter case the corresponding double salt is formed. The acid is often used as a reducing agent for the salts of silver; and it may be also so employed for those of gold, instead of the generally recommended iron sulphate. Recently oxalic acid, in combination with iron and potassium, has been employed for developing gelatine emulsion plates; it has been applied also to photometry, by Van Monckhoven, in combination with uranium, and by Eder in combination with mercury.

The uranium and mercury oxalates owe their employment for photometrical purposes to the fact that, when exposed to the sunlight, they are immediately decomposed, and give off carbonic acid gas, which, by means of a simple apparatus, can be made to raise a column of fluid in a small graduated tube. In this case, however, the pressure of the fluid column and the absorption of the gas must be taken into consideration or eliminated.

Of the less known oxalates, perhaps the most interesting is the double oxalate of iron and manganese. It can be easily prepared by nearly saturating acid oxalate of ammonia (or the neutral salt, acidulated with free oxalic acid) with hydric peroxide of manganese (MnO_2+H_2O), the operation must be effected in the dark. A solution of a splendid red color is formed, which, brought into the clear light of day, almost instantaneously loses its color with violent effervescence.

The hydric oxide of manganese required for this reaction may be prepared by precipitation from a solution of manganese sulphate ($MnSO_4$) by means of the so-called *Eau de Javelle*, a solution of sodium hypochlorite ($NaClO$) rendered alkaline by the addition of a slight quantity of sodium hydroxide. This black precipitate is well washed on the filter or by decantation, and then dissolved in acid ammonium oxalate.

Very sensitive is a piece of filter paper dipped in a mixture of permanganate of potash ($KMnO_4$) and oxalic acid—of course prepared in the dark. When exposed to direct sunlight, decomposition ensues instantaneously; even in the dark the red color is only permanent for a few minutes. If a solution of copper sulphate be mixed with one of ammonia oxalate of iron, and a glass vessel full of the mixture be set in the sun, the side of the vessel which is towards the sun will be coated with metallic copper. This reduction does not take place in the dark. Nevertheless, it is a question whether it be due to the direct action of light on the oxalate of copper that is formed; probably ferro-oxalate is first formed, and this, by loss of oxygen, is converted into ferri-oxalate.—*Photo. News.*

The Value of the Diamond Drill.

Mr. A. J. Severance, of San Francisco, says that the diamond drill has played a very important part in developing the mineral wealth of the West. The first great treasure house which these drills opened up was that known as the Consolidated Virginia and the California Bonanzas, which have yielded \$107,000,000, of which the stockholders have received \$74,000,000 in dividends. One of the owners of the mines told Mr. Severance that the diamond drill had realized for him \$5,000,000. All of the principal Comstock mines, and many of the largest mining properties located in California and Nevada, use these drills. They are also extensively used in Colorado; have pushed their way to most of the Territories; have been introduced and operated in New Mexico, old Mexico, and Australia. The Japanese Government has also been supplied with them.

Mr. Severance enjoys the distinction of having perfected the diamond drill, and of proving its utility by running a horizontal hole (then regarded an impossibility) eight hundred feet, taking out a complete cylindrical core, and showing the strata of every inch of rock passed through. This was done in Vermont. Soon after he introduced the drill upon the Pacific coast, with the results already noted.

Artificial Vanilline.

Whenever the synthetical chemist produces any well known substance artificially it meets with more or less opposition from persons who are not convinced that it is identical with the natural product. The *Badische Gewerbe Zeitung* publishes for artificial vanilline the following indorsement from Prof. Meidinger:

Artificial vanilline possesses undeniable advantages over natural vanilla. The latter loses its aroma easily and frequently spoils completely, while the former can be kept for any desirable length of time without the slightest change in quality. The activity of vanilla is very unequal, as the percentage of vanilline in the beans varies; hence a uniform flavor can only be obtained by the use of vanilline. The vanilla bean contains only 2 per cent of valuable material, with 98 per cent or more of worthless or even injurious matter, coloring and resinous, the removal of which is troublesome and tedious, before the pure flavor can be obtained. Cases of illness that occasionally follow the use of vanilla ices are probably referable to such impurities extracted from the bean itself.

In Germany the vanilline is mixed with sugar and put up in packages of different strength for different purposes. That prepared for chocolate manufacturers is 70 times as strong as good vanilla, or 50 times the strength of the finest vanilla. That intended for family use is put up in packages equal to one bean, and sold at 9 cents each. The vanilla essence for liqueur manufacturers contains 2 per cent of vanilline, and 2 grammes will flavor 1 liter of the liquor employed.

Dr. Meidinger has used artificial vanilline in his own house, and is able to speak from personal experience as well as from a chemical knowledge of its preparation and constitution.

Penetrative Power of the Electric Light.

Some time ago we mentioned an experiment with the Maxim light made at Saratoga, N. Y., to test the distance at which the electric light would illuminate a given spot, and it was found that a concentrated beam carried seven miles (to Ballston) furnished enough light to read by. A more crucial test of the great penetrating power of the electric light is furnished by the experiments of the officers of the French-Algerian Triangulation Service, who recently saw the electric light from the Spanish station of Zetica, from a distance of more than 164 miles. This observation is proof, if proof were wanted, of the great value of the light for maritime purposes, when it is exhibited from sufficiently elevated positions.

Cements.

Quite as much depends upon the manner in which a cement is used as upon the cement itself. The best cement that ever was compounded would prove entirely worthless if improperly applied. The following rules, says the *Druggists Circular*, must be rigorously adhered to if success would be secured:

1. Bring the cement into intimate contact with the surfaces to be united. This is best done by heating the pieces to be joined in those cases where the cement is melted by heat, as in using resin, shellac, marine glue, etc. Where solutions are used, the cement must be well rubbed into the surfaces, either with a soft brush (as in the case of porcelain or glass), or by rubbing the two surfaces together (as in making a glue joint between two pieces of wood).

2. As little cement as possible should be allowed to remain between the united surfaces. To secure this the cement should be as liquid as possible (thoroughly melted if used with heat), and the surfaces should be pressed closely into contact (by screws, weights, wedges, or cords) until the cement has hardened.

3. Plenty of time should be allowed for the cement to dry or harden, and this is particularly the case in *oil* cements, such as copal varnish, boiled oil, white lead, etc. When two surfaces, each half an inch across, are joined by means of a layer of white lead placed between them, six months may elapse before the cement in the middle of the joint has become hard. In such cases a few days or weeks are of no account; at the end of a month the joint will be weak and easily separated, while at the end of two or three years it may be so firm that the material will part anywhere else than at the joint. Hence when the article is to be used immediately, the only safe cements are those which are liquefied by heat and which become hard when cold. A joint made with marine glue is firm an hour after it has been made. Next to cements that are liquefied by heat are those which consist of substances dissolved in water or alcohol. A glue joint sets firmly in twenty four hours; a joint made with shellac varnish becomes dry in two or three days. Oil cements, which do not dry by evaporation, but harden by oxidation (boiled oil, white lead, red lead, etc, etc.) are the slowest of all.

Aquarium Cement.—Litharge, fine, white, dry sand, and plaster of Paris, each 1 gill; finely pulverized resin, 1-3 gill. Mix thoroughly and make into a paste with boiled linseed oil to which drier has been added. Beat it well, and let it stand four or five hours before using it. After it has stood for 15 hours, however, it loses its strength. Glass cemented into its frame with this cement is good for either salt or fresh water. It has been used at the Zoological Gardens, London, with great success. It might be useful for constructing tanks for other purposes or for stopping leaks.

Casein Mucilage.—Take the curd of skim milk (carefully freed from cream or oil), wash it thoroughly, and dissolve it to saturation in a cold concentrated solution of borax. This mucilage keeps well, and as regards adhesive power far surpasses the mucilage of gum arabic.

Casein and Soluble Glass.—Casein dissolved in soluble silicate of soda or potassa makes a very strong cement for glass or porcelain.

Cheese Cement for Mending China, etc.—Take skim milk cheese, cut it in slices and boil it in water. Wash it in cold water and knead it in warm water several times. Place it warm on a levigating stone and knead it with quicklime. It will join marble, stone, or earthenware so that the joining is scarcely to be discovered.

Chinese Cement (Schio-liao).—To three parts of fresh beaten blood are added four parts of slaked lime and a little alum; a thin, pasty mass is produced, which can be used immediately. Objects which are to be made specially waterproof are painted by the Chinese twice, or at the most three times. Dr. Scherzer saw in Pekin a wooden box which had traveled the tedious road via Siberia to St. Petersburg and back, which was found to be perfectly sound and waterproof. Even baskets made of straw become, by the use of this cement, perfectly serviceable in the transportation of oil.

Pasteboard treated therewith receives the appearance and strength of wood. Most of the wooden public buildings of China are painted with schio-liao, which gives them an unpleasant reddish appearance, but adds to their durability. This cement was tried in the Austrian Department of Agriculture, and by the "Vienna Association of Industry," and in both cases the statements of Dr. Scherzer were found to be strictly accurate.

Faraday's Cap Cement.—Electrical Cement.—Resin, 5 oz.; beeswax, 1 oz.; red ocher or Venetian red in powder, 1 oz. Dry the earth thoroughly on a stove at a temperature above 212°. Melt the wax and resin together and stir in the powder by degrees. Stir until cold, lest the earthy matter settle to the bottom. Used for fastening brass work to glass tubes, flasks, etc.

Cement for Glass, Earthenware, etc.—Dilute white of egg with its bulk of water and beat up thoroughly. Mix to the consistence of thin paste with powdered quicklime. Must be used immediately.

Glass Cement.—Take pulverized glass, 10 parts; powdered fluorspar, 20 parts; soluble silicate of soda, 60 parts. Both glass and fluorspar must be in the finest possible condition, which is best done by shaking each in fine powder, with water, allowing the coarser particles to deposit, and then to pour off the remainder, which holds the finest particles in suspension. The mixture must be made very rapidly, by

quick stirring, and when thoroughly mixed must be at once applied. This is said to yield an excellent cement.

Gutta Percha Cement.—This highly recommended cement is made by melting together, in an iron pan, two parts common pitch and one part gutta percha, stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid, and elastic; but it softens with heat, and at 100° Fah. is a thin fluid. It may be used as a soft paste, or in the liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, etc. It may be used instead of putty for glazing windows.

Iron Cement for Closing the Joints of Iron Pipes.—Take of coarsely powdered iron borings, 5 lb.; powdered sal-ammoniac, 2 oz.; sulphur, 1 oz.; and water sufficient to moisten it. This composition hardens rapidly; but if time can be allowed it sets more firmly without the sulphur. It must be used as soon as mixed and rammed tightly into the joint.

2. Take sal-ammoniac, 2 oz.; sublimed sulphur, 1 oz.; cast iron filings or fine turnings, 1 lb. Mix in a mortar and keep the powder dry. When it is to be used, mix it with twenty times its weight of clean iron turnings, or filings, and grind the whole in a mortar; then wet it with water until it becomes of convenient consistence, when it is to be applied to the joint. After a time it becomes as hard and strong as any part of the metal.

Kerosene Oil Lamps.—The cement commonly used for fastening the tops on kerosene lamps is plaster of Paris, which is porous and quickly penetrated by the kerosene. Another cement which has not this defect is made with three parts of resin, one of caustic soda, and five of water. This composition is mixed with half its weight of plaster of Paris. It sets firmly in about three quarters of an hour. It is said to be of great adhesive power, not permeable to kerosene, a low conductor of heat, and but superficially attacked by hot water.

Cement for Uniting Leather and Metal.—Wash the metal with hot gelatine; steep the leather in an infusion of nut galls (hot) and bring the two together.

Cement for Leather Belting.—One who has tried everything says that after an experience of fifteen years he has found nothing to equal the following: Common glue and isinglass, equal parts, soaked for 10 hours in just enough water to cover them. Bring gradually to a boiling heat and add pure tannin until the whole becomes ropy or appears like the white of eggs. Buff off the surfaces to be joined, apply this cement warm, and clamp firmly.

Litharge and Glycerine Cement.—A cement made of very finely powdered oxide of lead (litharge) and concentrated glycerine unites wood to iron with remarkable efficiency. The composition is insoluble in most acids, is unaffected by the action of moderate heat, sets rapidly, and acquires an extraordinary hardness.

Cement for Attaching Metal to Glass.—Copal varnish, 15; drying oil, 5; turpentine, 3. Melt in a water bath and add 10 parts slaked lime.

Paris Cement for Mending Shells and other Specimens.—Gum arabic, 5; sugar candy, 2; white lead, enough to color.

Porcelain Cement.—Add plaster of Paris to a strong solution of alum till the mixture is of the consistency of cream. It sets readily, and is said to unite glass, metal, porcelain, etc., quite firmly. It is probably suited for cases in which large rather than small surfaces are to be united.

Soft Cement.—Melt yellow beeswax with its weight of turpentine, and color with finely powdered Venetian red. When cold it has the hardness of soap, but is easily softened and moulded with the fingers, and for sticking things together temporarily it is invaluable.

Soluble Glass Cements.—When finely pulverized chalk is stirred into a solution of soluble glass of 30° B. until the mixture is fine and plastic, a cement is obtained which will harden in between six and eight hours, possessing an extraordinary durability, and alike applicable for domestic and industrial purposes. If any of the following substances be employed besides chalk, differently colored cements of the same general character are obtained: 1. Finely pulverized or levigated stibnite (gray antimony, or black sulphide of antimony) will produce a dark cement, which, after long burnishing with an agate, will present a metallic appearance. 2. Pulverized cast iron, a gray cement. 3. Zinc dust (so-called zinc gray), an exceedingly hard gray cement, which, after burnishing, will exhibit the white and brilliant appearance of metallic zinc. This cement may be employed with advantage in mending ornaments and vessels of zinc, sticking alike well to metals, stone, and wood. 4. Carbonate of copper, a bright green cement. 5. Sesquioxide of chromium, a dark green cement. 6. Thénard's blue (cobalt blue), a blue cement. 7. Minium, an orange colored cement. 8. Vermilion, a splendid red cement. 9. Carbon red, a violet cement.

Sorel's Cement.—Mix commercial zinc white with half its bulk of fine sand, adding a solution of chloride of zinc of 1·26 specific gravity, and rub the whole thoroughly together in a mortar. The mixture must be applied at once, as it hardens very quickly.

Steam Boiler Cement.—Mix two parts of finely powdered litharge with one part of very fine sand, and one part of quicklime which has been allowed to slake spontaneously by exposure to the air. This mixture may be kept for any length of time without injuring. In using it a portion is mixed into paste with linseed oil, or, still better, boiled linseed oil. In this state it must be quickly applied, as it soon becomes hard.

Turner's Cement.—Melt 1 lb. of resin in a pan over the fire, and, when melted, add 1/4 of a lb. of pitch. While these are boiling add brick dust until, by dropping a little on a cold stone, you think it hard enough. In winter it may be necessary to add a little tallow. By means of this cement a piece of wood may be fastened to the chuck, which will hold when cool; and when the work is finished it may be removed by a smart stroke with the tool. Any traces of the cement may be removed from the work by means of benzine.

Wollaston's White Cement for Large Objects.—Beeswax, 1 oz.; resin, 4 oz.; powdered plaster of Paris, 5 oz. Melt together. To use, warm the edges of the specimen and use the cement warm.

The Steam Fire Engine.

The following suggestions to engineers who have not had much experience in running engines are taken from the general orders of the New York Fire Department, and contain hints that should be useful in the care of all kinds of steam machinery:

1. In laying your fuel in the fire-box first lay plenty of shavings, then light dry kindling wood, filling your furnace full, which in most cases will give you steam enough by the time you arrive at a fire to commence work, provided you light your fire when you leave the house, which, as a general rule, is advisable.

2. If you use coal, be careful to keep a thin fire and not clog it. Use the coal in as large lumps as possible, and do not break it up unnecessarily in the furnace. The best coal for this purpose is clean cannel in lumps free from dirt and dust.

3. Be careful not to let so much fire collect under your engine as to burn the wheels. When working for a long time at fires there is some danger of doing so.

4. The Amoskeag boiler is an upright tubular boiler, with a submerged smoke-box and fire-box, surrounded with water. When the engine is running the water in the boiler should be carried so as to stand at the third gauge cock, which is placed near the top of the tubes, and it should never be carried below the center of the tubes, at which point the first gauge cock is located.

5. Avoid using an unnecessary amount of steam, the tendency is to use more than is required. From sixty to eighty pounds is as much as you will generally require to do good fire duty.

6. The engine has two suitable feed pumps for supplying the boiler with water. One of the pumps should be worked nearly all the time in order to keep water in the boiler at the proper height, and to preserve an even pressure of steam.

7. If brackish water is used for supplying the boiler, or if the boiler becomes foul from long use without being blown off, it is likely to foam or prime. If foaming occurs while the engine is working at a fire it may be prevented or diminished by opening the surface blow-off cock. After the engine is returned to the house, the water should be blown entirely out of the boiler through the blow-off cock near the bottom of the boiler with a steam pressure of about twenty pounds, and the boiler refilled with fresh water. This process may be repeated until the boiler becomes clean.

8. The pump upon the Amoskeag engine is a vertical double acting pump, with the cylinder surrounded by a circular chamber, divided vertically outside the cylinder so as to answer both for the suction and discharge chambers of the pump; it has a separate valve plate at the top and bottom of the pump carrying both the suction and discharge valves, the suction valve upon one side of the plate and the discharge valve upon the other. Each of those valve plates can be reached by taking off the top and bottom of the pump, which is so constructed as to be readily removed. The discharge and suction parts of the water chamber surrounding the cylinder are connected by a valve in the vertical partition which is called a relief valve.

9. With a single long line of hose it may be necessary to open your relief valve a little, but at all other times be particular to have it closed, except when you want to feed your boiler without forcing any water through the hose.

10. In the smokepipe, directly over the upper flue sheet, a valve is placed which is called the variable exhaust valve. By operating this valve the size of the aperture for the escape of the steam from the steam cylinder is increased or diminished, thus regulating the draught of the chimney and the heat of the fire. This valve should be closed when the engine is started until a fair working pressure of steam is obtained, after which it may be opened.

11. Care should be taken to have the suction hose and its connections air tight.

12. Open your discharge gate and cylinder drain cock before starting your engine.

13. Don't let the flues of your engine get filled up.

14. Be particular to take your engine off the springs before you work it and to place it on the springs again when done working.

15. With a long line of hose on be particular to open your throttle gradually. If you open it too suddenly you are liable to burst your hose.

16. The pumps of the engine should be examined at least once in six months to see that the valves and all parts are in good condition. The pump valves should have a lift of about three-eighths of an inch and the suction valves the same lift.

17. The inside of the steam cylinders and the steam valves should be oiled or tallowed always after the engine has been worked at a fire, and as often as it may be necessary to keep them well lubricated, and all the parts of the engine where liable to friction should be kept well oiled. Be particular to use an abundance of oil on the link block, where there is more friction than in any other part.

18. The running gear and every part of the engine liable to disarrangement or accident should be thoroughly examined every time after the engine has been out of the house, whether it has been worked at a fire or not.

19. Whenever your engine is repaired try to help to do it yourself, as by so doing you get familiarity with it that you can in no other way obtain. If the feed was turned on and the feed pumps were at work, but if the water did not run into the boiler, what would be done in such a case? To examine the hydrant and see if it was turned on or off; examine the check valve to see that it was in operation; this can be done by applying the ear to the chamber and ascertaining if the valve rises and falls at each stroke of the pumps, and also apply the hand to the pipe below the check valve in order to ascertain if it is cool; if they are all right, examine the blow-off cock and all other connections with the boiler to ascertain if they were closed; and if they are closed, the pumps must be pumping air into the boiler instead of water; also examine the pumps and induction pipes, in order to ascertain if they were not leaking, and if so stop the leak. If the check valve should not be in operation, examine the pumps, also the pump valves, and see if they were not bursted, either of which causes prevent the pumps from delivering water to the boiler.

There are four causes for feed pumps becoming hot, namely: 1st. There may be so small a quantity of eyedetious water used to cause it. 2d. It may be carried from muddy water or tight packing. 3d. The check valve and relieving valve may be caught up or very breaky, allowing the hot water from the boiler to run back to the pumps. 4th. External application of heat, the pumps being situated near the boiler.

Steam is a thin elastic fluid generated by the application of heat to any fluid (water generally used); the power of steam is its expansion; superheated steam is any steam which has been heated in a separate state to a high degree of temperature under pressure; in this condition its mechanical and chemical power are wonderfully increased. Water will boil at 212° Fah.

The following are the supplies which every engine in the department is furnished with: 20 feet of suction hose, a suitable brass strainer for suction hose, a brass hydrant connection for suction hose, a brass signal whistle, two plated gauges, one to indicate the pressure of steam upon the boiler and the other the pressure of water at the pumps or leading hose; two discharge pipes for leading hose, with a complete set of changeable nozzles, from 7/8 inch diameter to 1 1/4 inches diameter inclusive; two brass-bound fireman's hand lanterns, a large brass oil can, a jackscrew for convenience in oiling the axles, a coal shovel, and fire poker. A small tool box furnished with such small tools as may be required about the engine when in use, such as hammers, wrenches, and the like.

Dimensions of a second-class double plunge engine, crane neck frame; Height from floor to top of smokestack, 8 feet 8 inches; length over all, including tongue, 23 feet 2 inches; diameter of boiler, 2 feet 7 inches; diameter of pumps, 4 1/2 inches; stroke of pumps, 8 inches; diameter of steam cylinders, 6 1/2 inches; number of discharge gates, 2; capacity in gallons per minute, 700; weight, about 5,400 pounds. Second-class double pump crane neck engine: Diameter of grate surface, 32 inches; size of door, 8 by 12 inches; number of tubes, 258; diameter of tubes (internal), 1 1/4 inches; bottom of boiler to bottom of fusion pipe, 20 inches; bottom of fusion pipe to 1st gauge cock, 12 inches; distance between gauge cocks, 5 inches; number of gallons to 3d gauge cock, 40 cubic feet; steam room, 3 feet.

American Losses by Fire.

The amount of losses in the United States by fire during 1879, as reported to insurance companies, was $77,703,700; add to this the uninsured losses that are not reported, and it will fall but little short of the $100,000,000 claimed as the annual loss in this country. Canada is not included in these reports.

In the four years, 1875-6-7 and 8, there were burned wholly or in part, in the United States: 1,354 hotels, 263 churches, 182 school houses, 40 court houses, 42 alms houses, hospitals, and asylums—1,883 in all. It would naturally be supposed that buildings of the character named would be built with more than ordinary care, but the record does not show such to be the case. Indeed, the more pretentious the building, the more careless seem to be the owners.

AGRICULTURAL INVENTIONS.

Mr. Joseph Custer, of Goshen, Ohio, has patented a seed planter, so constructed that it may be used for planting potatoes and small seeds, as required.

Mr. Nathan L. Brass, of Juniata, Neb., has patented an improved sulky-harrow, which is simple and convenient in use, being easily raised from the ground and adjusted to work at any desired depth in the soil.

A combined scraper and fork, patented by Mr. George P. Ruhle, of Swengel, Pa., is intended for use as a scraper, hay lifter or fork, and dung fork; and the invention consists in a novel combination and arrangement of parts, whereby the apparatus may be conveniently used for the purposes named.

NEW COTTON PICKING SHADE.

The annexed engraving scarcely requires description, as the purpose and advantages of the invention will be readily seen. Cotton picking, at best a laborious occupation, becomes irksome when conducted under a burning tropical sun; and a device which will afford to cotton pickers an efficient protection from the influence of strong sunlight and heat should receive attention. Such a device is shown in the accompanying engraving, and it must prove beneficial to both laborers and employers, for without a doubt more work can and will be done when a protection of this kind is afforded. The invention consists simply of a protective shade of cotton cloth, mounted on a light frame provided with wheels, which facilitate its movement along the rows of cotton to be picked.

This invention was recently patented by Mr. J. C. Benthall, of Schulenburg, Texas.

BENTHALL'S COTTON PICKING SHADE.

A Silver Fossil.

The *Bulletin* of the Geological Society of France describes an ammonite of silver, found in a silver mine at Caracoles, South America, by M. Fremier, who was for some time director of the mines at that place. This remarkable specimen was found with a number of other ammonites belonging to the two species *A. peramatus* and *A. plicatilis*, which had not been mineralized with silver salts. The ammonite in question, however, had been entirely replaced by chloride of silver, which had been partially reduced to the metallic condition. Light is thrown by this specimen upon the origin of the native silver which occurs in the Caracoles mines; for it is only fair to infer that this metal has, in like manner, been reduced from the state of chloride.

PUMPING SYSTEM FOR HYDRAULIC PRESSES.

There are two objections to the use of hydraulic presses as ordinarily arranged. One is, that the press works at a uniform rate of speed throughout the entire distance traveled by the platen, and therefore of necessity works slowly; the other is, that the press must be near the source of power to work to the best advantage.

The accompanying engraving represents an improved system in which these objections are not found, and which renders the hydraulic press applicable in many places where without these improvements it could not be used. It also increases the capacity by giving a greater supply of water under pressure during the early part of the operation of pressing.

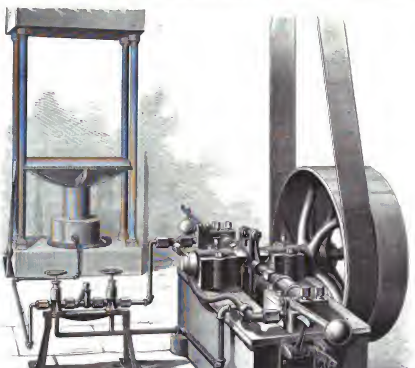
The pump shown in the engraving has two pistons, one of which is larger than the other, and designed to be applied at the beginning of the operation of pressing, to supplement the smaller one, and to accelerate the plunger of the press by forcing large quantities of water into the press cylinder. When the prescribed limit of pressure for the larger pump is reached, the pump is thrown off by means of the lever seen at the side of the press in the background. This lever is connected by bell cranks and shafts with the cam seen under the relief valve lever of the larger pump; the heavy finishing pressure is given by the smaller pump.

The valves to these pumps are of large area, and are so arranged that they may be readily taken from their seats to remove any foreign substance, or for the purpose of refitting, should it become necessary. All of the parts subjected to wear are capable of being easily "taken up," and the machine is constructed on the interchangeable plan. By employing a set of valves shown in the middle of the engraving, the pump may be placed in any convenient position, no matter how far distant from the press. The press will then be controlled by these valves, while the pump is allowed to run continuously.

Pumps are made on this plan with four or six plungers By modifying the arrangement of the valves, several presses may be conveniently operated with a two-plunger pump.

We are informed that a large number of these pumps are in use on a great variety of work in all parts of the United States, giving good satisfaction. Many of them are in the hands of parties having little mechanical skill.

For further particulars address E. Lyon & Co., 470 Grand street, New York City.



IMPROVED PUMPING SYSTEM FOR HYDRAULIC PRESSES.

Rapid Photos.

At a recent meeting of the Edinburgh Photographic Society an interesting lecture was delivered by Mr. W. H. Davies on "Rapid Studies from Nature," during which he introduced a number of screen pictures from instantaneous photos, representing movements of life in various forms. Among the pictures thus shown were the Muybridge horse pictures, from California, heretofore shown in our paper. These photos represented the various positions of the horse's feet in the act of stepping, and were taken while the animal was going at a 2:40 gait. The lecturer, after complimenting the American photographer who took these remarkable pictures, added: "I may mention that the general speed of a fast trotting horse is about two and a half miles a minute!" Our cousins across the water are so unaccustomed to the sight of fast trotters that perhaps it is not surprising that the lecturer's statement should have been received as correct. Their ideas of the speed of American horses must have made a most rapid advance.

THE House Committee on Patents have decided to report adversely on the application for an extension of the patent on the Miller platform and coupler, on the ground that the patent has run long enough, and that the patentee has received sufficient remuneration already.

How to Get Rid of Rats in Mills and Granaries.

Millers are well aware of the terrible annoyance occasioned by rats in the mill and warehouse, and may find a useful hint in the following, from a note presented to a French industrial society, by M. Benner. The *American Miller* translates:

"Every one understands the ravages caused by rats in warehouses, storehouses, granaries, and the like. The amount of damage inflicted by these guests is appreciated by those engaged in pursuits the establishments of which suffer periodical invasions by the rodents. Their annual depredations cost millions of money. To destroy these animals, traps of all kinds have been employed and poisons of every description of undoubted deadly power. But the instinct of self-preservation in these unwelcome guests renders them inefficacious, and often injures domestic animals. Lately, one of my friends related to me the following, which took place in a large mill operated by his father. There the rats live, in a happy quiet, for the reason that the proprietor of the establishment has discovered by experience that each time he attempted to destroy them by traps or poisons, no longer contenting themselves with a diet of grain and flour, they became aggressive, and appeared to take vengeance by gnawing into the bolts and sacks in the course of a single night.

"'Like every industry which uses a water course, mine had suffered particularly from the periodical invasion of rats, which, at the approach of the rigorous season, took up their winter quarters in the warmest parts of the establishment. At this time they quit their burrows on the banks of the stream and invade the premises, gradually working up from the basement to the loft. For years I tried every means to accomplish their destruction, but to no purpose. One day when the work of repairing a wall of masonry, which supported the engine, called me below, I saw that the limestone upon which the platform of the cylinder rested had been gnawed down to the cement. This warm and dark passage had served as a retreat for the rats who raided the establishment. The idea struck me to suffocate them in their den. I took some moist chloride of lime, which I passed into each opening, and when all the rat holes were covered with paste, I sprinkled over it a small quantity of oxalic acid. The mason immediately filled up all the openings, but not before some of the rats, disturbed by the freeing of the chlorine gas, had escaped.

"'During the winter which followed, I was able to see that the rats were a little less numerous in that part of the establishment. Encouraged by this partial success, I carefully sought out the rat holes on the ground floor and went through a similar operation, with the difference that I used liquid chloride, which I poured into the rat holes until the liquid flowed back to the opening. Then I poured in hydrochloric acid diluted with water, after the earth or masonry had absorbed the greater part of the first liquid. By this mixture a violent escape of chlorine gas is produced, and the rats were invariably asphyxiated. When the operation was completed, the holes were filled up to prevent the coming of other inhabitants. That year I noticed that the rats had disappeared from the ground floor, but I could still hear them in the ceiling of the other stories. I sought all the openings by which the rats penetrated between the ceiling and the floor, and prepared pieces of sheet iron of a size sufficient to cover each hole completely. Then I placed several handfuls of cotton at the bottom of the opening in such a way as to cover the greater part of it, and dipped a piece in the moist chloride of lime and dropped it upon the first layer destined to absorb the liquid part. Then I sprinkled on some powdered oxalic acid, and alternately introduced the chloride and the acid until the entrance was filled, and then I nailed on the piece of sheet iron. This operation was gone through with in each story, and the result was complete; all the rats perished from the fumes of chlorine.

That was fifteen years ago, but whenever I discover a rat hole in the establishment I administer prompt justice with chlorine and acid.'"

Spectroscopic Notes.

Prof. H. Vogel recommends the use of a small hydrogen flame for spectroscopic work in places where there is no illuminating gas, as in the country and in some private houses. It is much hotter than alcohol, and, in fact, not inferior to the Bunsen gas burner in heat. Any form of constant generator can be employed, as the impurities in ordinary zinc and acid do not affect the spectrum. The gas is burned from a blow pipe jet, as a glass jet would yield faint spectra of the alkalies.

The same distinguished spectroscopist has also published a simple method for the detection of cobalt in the presence of nickel and iron. The three metals are converted into sulphocyanides by means of potassic sulphocyanide. Carbonate of soda is now added to the intensely red solution until the iron is all thrown down. The solution is then filtered and shaken with ether and amylic alcohol, in which the sulphocyanide of cobalt dissolves with a blue color. When nickel as well as cobalt are present the ethereal solution is greenish, but the cobalt is detected by characteristic absorption bands between C and D. In a mixture of 400 parts of ferric chloride to 1 part of cobaltic chloride, the latter was distinctly visible, as also in the presence of 200 parts of nickel. This test for cobalt is so delicate as to indicate the presence of 0·0000258 gr. of metallic cobalt to the cubic centimeter of solution. Sulphocyanide of nickel solutions give no absorption bands, and the sulphocyanide of cobalt in aqueous solution only shows a broad dark place in the green.

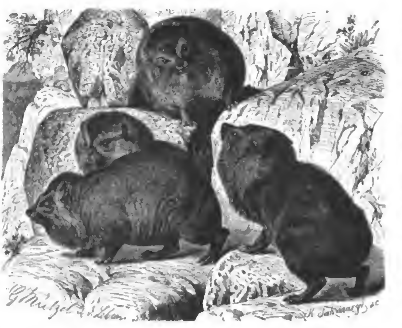
THE HYRAX.

One of the most curious little animals in existence is the hyrax, interesting not so much from its imposing external appearance, as for its importance in filling up a link in the chain of creation.

About as large as a tolerably sized rabbit, covered with thick, soft fur, inhabiting holes in the banks, possessing incisor-like teeth, and, in fine, being a very rabbit in habits, manners, and appearance, it was long classed among the rodents, and placed among the rabbits and hares. It has, however, been discovered in later years that this little rabbit-like animal is no rodent at all, but is one of the pachydermata, and that it forms a natural transition from the rhinoceros to the hippopotamus. On a close examination of the teeth, they are seen to be wonderfully like those of the hippopotamus, their edges being beveled off in a similar manner, and therefore bearing some resemblance to the chisel-edged incisors of the rodents. There are several species of hyrax, one of which inhabits Northern Africa and Syria, while the other two are found in Abyssinia and South Africa.

The South African hyrax is termed by the colonists klipdas, or rock rabbit, and is found in considerable plenty among the mountainous districts of its native land, being especially common on the sides of the Table Mountain. It is largely eaten by the natives, who succeed in killing it in spite of its extreme wariness and activity. Among the crevices and fissures in the rock the hyrax takes up its abode, and may often be seen sitting in the warm rays of the sun, or feeding with apparent carelessness on the aromatic herbage of the mountain side. It is, however, perfectly secure, in spite of its apparent negligence, for a sentinel is always on guard, ready to warn his companions by a peculiar shrill cry of the approach of danger. Sometimes the hyrax is seen at a considerable height, but is often observed near the sea shore, seated on rocks which are barely above high-water mark.

Besides mankind, the hyrax has many foes, such as the birds of prey and carnivorous quadrupeds, and is destroyed in considerable numbers. The fore feet of this animal are apparently furnished with claws like those of the rabbit, but on a closer inspection, the supposed claws are seen to be veritable hoofs, black in color, and very similar to those of the rhinoceros in form. The hyrax is an agile little creature, and can climb a ragged tree trunk with great ease. It is rather hot in its temper, and if irritated becomes highly excited, and moves its teeth and feet with remarkable activity and force.



HYRAX.—(*Hyrax abyssinicus.*)

THE PICKEREL FROG.

BY C. FEW SEISS.

The pickerel frog (*Rana palustris*, Le Conte) is the prettiest and most strongly marked of the *ranidæ* found in this section of the country. Its ground color above is pale yellowish brown, with four rows of more or less regular, squarish dark brown spots from the head to the vent. There are commonly three or four spots in each dorsal row, from behind the eye to the bend of the back (supra iliac prominence), but in a specimen taken near Camden, N. J., these

THE PICKEREL FROG.—(*Rana Palustris.*)

spots are confluent, thus forming two blackish bands (see left-hand figure). This is the only specimen I ever saw thus marked, although I have frequently observed two spots to be confluent. The spots are always margined with dull grayish white. There are two glandular dorsal folds, one on each side of a yellowish or bronze color, but they are not so well defined as in the crying frog (*Rana clamitans*) or shad frog (*R. halecina*). The body beneath is yellowish-white; posterior part of thighs granulated and of a bright yellow color in life. The legs and feet are barred and spotted with dark brown. Dr. Gunther, in his "Catalogue of the Batrachia Salientia," gives as specific characters: "Body with *two* glandular folds on each side. Above *greenish*, with a row of squarish darker spots between the glandular folds." I have found generally but one fold, and where two do exist the upper cannot properly be designated as such. It also commonly runs through the row of spots, and not above it. I have never seen a "greenish" pickerel frog, either alive or in alcohol.

The pickerel frog is for the most part solitary in its habits, except during the breeding season. Although it is called *palustris* (marshy), it is found in springs and brooks more frequently than in low and extensive marshes. With the exception of the wood frog (*Rana temporaria sylvatica*), this is the most slender and active species we have. It will spring upward several feet to seize an insect on the wing.

I have noticed a peculiar way it has of showing its displeasure. Thus when I dropped an insect in the vivarium near two of these frogs, and the most active or lucky seized and swallowed it, the disappointed frog wheeled around and struck the object of his displeasure in the face and eyes with his tongue. And it is evident from the way the assaulted frog closed his eyes and moved away, that he did not relish such treatment.

We had a male of this species in our vivarium two winters ago, who would persist in creeping down and completely hiding himself under the moss at the approach of every cold spell during the winter.

The length of an adult pickerel frog, from nose to vent, is about 3 inches. It is found in the eastern United States from Maine to Virginia.

Distribution of Plants.

BY REV. L. J. TEMPLIN, HUTCHINSON, KANSAS.

The world is full of wonders to every one who has not made up his mind to be astonished at nothing he may see. To the thoughtful mind there is much in nature to inspire wonder and admiration. The wise adaptation of means to ends, and the beautiful harmony that exists throughout all the realm of organic nature, lead the mind, free from bias, to the inference that some wise, intelligent power orders and governs all these relations and harmonies. Perhaps nowhere in nature is there a more manifest exhibition of wisdom in the adaptation of means to the accomplishment of a worthy purpose, than is seen in the various methods employed in nature for the dissemination of plants by the distribution of seeds.

In looking at this subject with an intelligent eye, the mind cannot shut out the conviction that some intelligent designer must have been employed in planning this scheme that has so much of both excellence and variety to recommend it to the judgment. To say that all this is to be attributed to chance, is to endow chance with all the attributes of a Deity, which is the very reverse of the idea intended to be conveyed by the term. In the sense intended it is perfectly absurd to attribute this or any other work to chance, for in that sense chance is nothing, and consequently can do nothing. So we regard it as the result of evolution; but I cannot see that this relieves the difficulty, even if the truth of the theory of evolution be admitted. Evolution is simply the working out of certain results under the operation of law. But what is this law? It is not correct to say that it is force, though I think many make this mistake. Law is only the established order or manner in which force operates; so that if we admit the intervention of law and a thousand or ten thousand secondary causes, still this law must have originated with a lawgiver, and behind all these secondary causes the mind must rest at last on the first cause, the author of all other causes. But I did not start out to write a moral or philosophical essay, but to call attention to some of nature's method of distributing the vegetable kingdom over the world. In producing these results we find three classes of agents at work: the waters, the winds, and animals, besides certain arrangements within the plants themselves for the accomplishment of this purpose. And we find the seeds themselves adapted to these different means of transportation. The light character of many seeds well adapts them to floating from place to place, while their impervious coverings protect them while being carried long distances by the currents of the ocean or of rivers, and then when they lodge on some island or other shore they readily spring up and grow. What, for instance, can be better adapted to floating from island to island than the tough, corky covering of the cocoanut? The seeds of grasses and other plants are washed down from the higher grounds by streams, and they are thus widely distributed.

The seeds of many plants, as of the dandelion, thistle, and a long list of similar plants, are furnished with a tuft of downy or silky pappus, that will enable them, when ripe, to float away on the breeze and thus be scattered far and wide. The seeds of some species of poplar, as cottonwood, are attached to a bunch of fine cotton that serves as a buoy to bear them up through the air, by means of which they are frequently carried many miles from the parent tree. Seeds are often disseminated through animal agency. Animals frequently carry seeds and nuts away and bury them for winter food, where they are forgotten and left to grow.

Many seeds of fruits are swallowed by birds and carried to distant places and voided uninjured, and there spring up and grow. Thus the seeds of cherries, grapes, gooseberries, blackberries, and many others of like nature, are sown broadcast over a large extent of country. During an invasion of the Rocky Mountain locusts into Iowa a few years ago, they left the ground where they fed thickly strewn with the seeds of some species of grass, new to that locality.

which they had brought from the far Northwest. Many seeds are provided with hooked barbs, by which they cling to clothing and the coats of animals, and are carried about from place to place.

Many people are familiar with the cockle burr, the Spanish needle, the "beggar lice," and burdock, and how tenaciously they adhere to any surface where they can get a hold. To this we may add the sand burr (*Cenchrus tribuloides*), with its sharp spines, one of the most execrable weeds I have made the acquaintance of. Some seeds, as of the maple, ash, elm, etc., are furnished with a wing that causes them to sail off some distance in falling. The locust, Judas tree, or redbud, and others, have a light pad that will often sail off to a considerable distance, thus scattering their seeds.

Some kinds of bean have the pod so arranged that when it bursts it suddenly twists into a coil, throwing the seeds a considerable distance. This habit in the *Impatiens*, or touch-me-not, geranium, etc., is well known. The squirting cucumber (*Momordica elaterium*), when ripe, bursts with a considerable report, throwing its seeds many feet.

A few plants, when their seeds are ripe, travel over the country and sow them themselves. A good example of this kind is the "tumble weed," about the true name of which the doctors disagree. Two species grow here; the larger, which is the tumble weed here, grows in a thick cluster of very slender branches, and these so numerous that the bunch, which is often as big as a hogshead, can scarcely be seen through. When ripe they are torn from the roots by the wind, and then they roll and tumble, often with the speed of a racehorse, till they meet an obstruction that they cannot surmount, and there they rest till the wind changes, and then they start again; and this is kept up till they are worn out and broken to pieces. Their seeds are thus scattered over all the country.

A plant that grows on the deserts of Africa, the rose of Jericho (*Anastatica hierochuntica*), when ripe, curls into a ball, becomes detached from the soil, and rolls about before the wind till a light shower of rain falls, when it opens its seed pods and drops its seeds, which germinate in about eighteen hours. The wisdom of the arrangement here is seen when we remember that if it remained where it grew the whole plant would probably be covered by the drifting sands, and that if its seeds did not germinate quickly, while the transient moisture lasted, they never could grow at all. Thus does nature care for her children.—*Gardener's Monthly.*

Cinchona Culture for the Pacific Coast.

Mr. Willis Weaver, of Bogota, South America, has written a long letter to the Department of Agriculture advocating the introduction of the cinchona tree in California.

After reviewing the conditions under which the cinchona tree thrives naturally in South America, and, under cultivation, in India, Mr. Weaver says: "The cinchona seems to seek a dry soil, but a climate affording plenty of rain in certain parts of the year. The coasts of Northern California and Oregon would fulfill the conditions as to moisture; the slopes of the mountains would probably furnish hilly ground very similar to that occupied by the tree in its native habitat; while I believe that the temperature would admit of its cultivation even north of the mouth of the Columbia. It is also uncertain as to how far any undue dryness of the atmosphere may be overcome by irrigation. The surprising results already attained in the cultivation of the trees prepare us to expect further advances, and this may be one of them as naturally as anything else.

It is well known that the barks produced under cultivation are much superior to the natural bark, as the process of mossing the tree causes a remarkable development of the alkaloids in which their virtue consists. Also that the cultivated trees are not destroyed. A strip is taken off reaching the length of the trunk and one-third its circumference. The wound is then dressed with straw matting and kept wet until the bark forms anew. The next year another strip is taken, and so on, indefinitely. I am told that the harvest begins when the tree is five years old, but am not in a position to verify the statement.

"I have calculated roughly, according to the prices of land and labor here, that a plantation of a hundred acres might be put in at less than $1,000 an acre, covering all outlay—or say $1,500 to cover interest and all contingencies."

A yield of $8,000 an acre has been reported from Indian plantations. Mr. Weaver is convinced that with a wise choice of sites and judicious treatment, together with a careful selection of the proper varieties, the cinchona tree could be cultivated in many parts of the Pacific coast, and probably in New Mexico; that if irrigation can be made to supply the place of a naturally moist climate, the cultivation can be carried into a large part of the Colorado Valley and Texas, as well as into Northern Georgia and Alabama, and thence north along the southern slope of the Blue Ridge. He would not be surprised if the hardier varieties were found to grow even in Virginia and Colorado and in Arkansas, in favored situations on the southern slopes of the Ozark mountains.

Non-inflammable Wood.

At a meeting of the British Association recently held at Sheffield, Col. P. P. De la Sala exhibited non-inflammable wood for building purposes, also wood shavings, non-inflammable, for the manufacture of mats, rope, etc. The inventor thus explains his peculiar method, which is already patented:

"Though all alkaline compounds reveal the property of rendering vegetable matter more or less pliable and non-inflammable, I preferably make use of carbonates of fixed alkalies in the following way: I dissolve in cold or warm clear water carbonates of potash or soda, or I make use of them in a solution of filtered water heated to the boiling point, and add hydrate of lime to this solution, graduating the strength so as not to exceed a specific gravity of 1·060 if potash is used, or 1·050 when soda is used. In the first case, the strength of the solution corresponds to about 30 grains of hydrate of potash to the fluid ounce, or about 20 grains of hydrate of soda to the fluid ounce. Wood to be used in naval construction, and in buildings or structures of wood on land, as well as vessels and land buildings already constructed, can be rendered fireproof by saturating the floors and decks, and all exposed woodwork, with alkaline lyes, and when dry, the wood may be whitewashed, painted, or varnished in the usual way.

"For boards, planks, or thicker pieces of timber, I graduate the time of immersion so as to form a coating of from one-sixteenth to one-eighth of an inch, which can be obtained in from four to twelve hours, according to the more or less porous nature of the wood, or the compactness of its fiber. I consider a coating of about one-eighth inch deep to be a sufficient fire protection for all kinds of timber for building purposes, as the spread of fire and great conflagrations generally originate in relatively small causes, such as burning cinders, dropped sparks from fireplaces, matches accidentally ignited, inflamed liquids, candles left burning, etc.; but the fireproof coating can be made deeper, or even to go through the whole timber, in the event of its being considered desirable to combine great flexibility with absolute non-inflammability. In this case I make use of hydraulic or other pressure, so as to force the alkaline lyes through the wood to the extent desired."

A comparison is yet to be made between this method and others as to relative cost of the flame prevention. *Per se*, any method of treatment whose cost exceeds that of fire destruction in a given case, is practically inapplicable.

The American Missionaries in Turkey.

A special correspondent of the London *Times*, in a recent letter to that journal from Turkey, dated at Aintab, Dec. 25, 1879, pays the following high tribute to the value and influence of American missionaries in that empire:

In a former letter I promised to give some account of the work of the American missionaries in Asia Minor, and I the more readily hasten to fulfill that promise, as the work of those missionaries is not without interest and importance in respect to the political future of the country. Not that the missionaries have interfered or are likely to interfere directly in political affairs, but it seems more and more evident from year to year that the institutions established by the missionaries are having a positive effect in making men acquainted with their natural rights, and also in showing to the native populations of the country that self-reliance and self-exertion are the only roads to happiness and prosperity. The statistics of the various missions in Asia Minor for the past year have been furnished me in advance of publication. As I turn them over I confess to a feeling of considerable embarrassment at attempting to compress the statistics, with needed explanations, into a single letter. If this is found impossible, I shall crave your indulgence for supplementary statements in a subsequent letter.

The first American missionary arrived at Constantinople in 1831; as the operations of the Americans have continued from that date to the present time without interruption, they extend over a period of 49 years. Much time was spent at first in exploring the country, mastering the languages of the people, becoming acquainted with their manners and customs, and in attempts, often unsuccessful, to overcome the prejudices and fanaticisms of those who looked with suspicion on the arrival of these strangers from a distant land.

As soon as possible after their arrival the missionaries began to work through the press, and they have gone on steadily through this department until the business of translating, publishing, and circulating their books and newspapers has reached large proportions—large at least for a semi-civilized country like Turkey. As no one language is used by all the races of Asiatic and European Turkey, it has been necessary to prepare books in several different languages—thus, for example, the Bible has been translated into the Arabic, Armenian, Turkish, Bulgarian, and Hebrew-Spanish languages, while editions have also been issued in Armeno-Turkish and Greco-Turkish, and portions of the Bible also in Kurdish. As might be expected, a large proportion of the books published by the missionaries are on religious and moral topics; yet there are many works on other subjects; in the list before me I find arithmetics, geographies, grammars, histories, works on mental philosophy, on teaching, algebras, geometries, a compendium of physiology, and other works of a similar kind. The history of the Reformation in the sixteenth century is given in several compact volumes. One solid octavo of several hundred pages is devoted to church history. From the report of the publication department for the past year I find that the missionaries have issued in the Armenian language during that year 19,175 copies of different works, amounting to 2,122,500 pages; in the Armeno-Turkish language, 23,300 copies, amounting to 1,324,300 pages; in the Greco-Turkish, 3,810 copies, consisting of 287,760 pages; and in the Bulgarian language, 14,915 copies, in 2,462,620 pages; or a total in the past years of 61,200 copies, in 6,397,000 pages. The same report states that the entire number of copies issued from the mission press from the beginning amounts to 2,248,354, and the whole number of pages issued in the native languages of Asiatic and European Turkey amounts to 335,508,968. The expenditure in the publication department during the past year amounted to 388,510 piastres (T£=100), or about £3,300 sterling. Among the most useful and popular of the publications of the missionaries are several newspapers, partly religious and partly secular; these are published in the Bulgarian, Armenian, Armeno-Turkish, and Greco-Turkish languages. As the editors of these papers, during a long series of years, have taken much pains to furnish only the most reliable information to their readers, the papers have an established character for accuracy, which is not enjoyed by great numbers of sensational publications in the Levant. In this brief summary of what the Americans are doing in Turkey through the press, I have omitted entirely the operations of the missionaries in Syria and Egypt. As is well known, those operations are on an extended scale, but they are rather outside of the region to which this letter relates.

The missionaries attach great importance to the organization of native congregations and churches. These congregations are presided over by native preachers and pastors. The churches manage their own affairs, and support their pastors so far as possible, and, to a large extent, their own common and high schools. The missionaries, in dealing with the native congregations, act uniformly on the principle of helping only those who help themselves. The result has been that throughout the country are found many communities of intelligent men who are making continued and earnest efforts to sustain the institutions that have been founded by the missionaries. In many cases these communities are what are called self-supporting—that is, they draw nothing from foreign sources toward the expenses of their own schools, churches, and congregations. In all cases a large percentage of the expenses incurred are borne by the people, the proportion depending upon the size and ability of each congregation. Some idea of the number and importance of these congregations may be obtained from the following statistics. These statistics relate only to three missions in Asia Minor, and which are known as the Western, Eastern, and Central Turkey Missions. They do not include the reports from European Turkey and from Syria and Egypt:

The whole number of registered Protestants in Asia Minor is 24,975. These are formed into a separate civil community, having a chief or headman at Constantinople. The number of separate congregations of Protestants is 235; these are found in all the large cities and in many of the towns and villages that are scattered through the country, from the Black Sea to the Mediterranean, and from Constantinople to the borders of Persia. The total number of educated native pastors and preachers is 116, while the whole number of school teachers is 312. Quite a number of the native preachers, as well as some of the teachers in the high schools and colleges, are men of marked ability. The number of common schools is 288, and the whole number of scholars in these schools is 9,621. The branches taught in the common schools are reading, writing, spelling, arithmetic, geography, grammar, and sometimes algebra, physiology, and English. Great attention is given to the organization and management of Sabbath schools. The object of such schools is the simple study of the Christian Scriptures. The number of such schools is reported at 176, with an average attendance of 15,423 persons. Men, women, and children attend the Sabbath schools, and engage for an hour and a half each Sabbath in the earnest study of the Bible, aided by competent teachers, and under the general direction of the native pastors. That the native people are really in earnest in this work appears from the contributions which they make for its support. Very few men of wealth have joined the Protestants, while the great majority of the members of that community are men from the humbler classes of society—men who, under the accumulated burdens imposed upon them by the Turkish Government, find it very difficult to support themselves and their families. Yet these laboring men gave during the past year, for the support of their own churches, schools, and other objects, 468,247 piastres (T£=100), or £4,214 sterling. The missionaries feel, doubtless with good reason, that this is one of the most encouraging items in their annual budget, not that the amount, in itself considered, is large, but because it is the best possible evidence of the sincerity and zeal of those who have joined the Protestant communities. One of the most encouraging results of the work of the missionaries in Asiatic Turkey is seen in the demand for schools, seminaries, and colleges of a high grade; this demand is not confined to either sex, nor to any particular people. To meet this demand boarding schools for girls, and high schools, colleges, and theological seminaries for young men, have been established at many important centers in Asia Minor. These institutions are all under the immediate control of the missionaries themselves, assisted in every case by competent native professors and teachers.

A detailed account of these educational institutions would lead me too far from the purpose of this letter, yet I may mention, as examples of what the Americans are doing in this respect, the girls' boarding schools at Marsovan, Brusa, Bitlis, Mardin, Kharpoot, and Aintab, the theological seminaries at Marash, Kharpoot, and Mardin, and the two colleges recently established at Aintab and Kharpoot. As these institutions are at central points, and as they are already exerting very considerable influence in the country, those who wish to obtain more complete information in regard to the

missionary work in Asiatic Turkey would do well to put themselves in communication with the missionaries in charge of them. Robert College at Constantinople, and the Syrian Protestant College at Beyrout, are too well known to the British public to require special notice at my hands. It gives me pleasure, however, to report in regard to both of those deservedly popular institutions that their prospects were never so full of hope as at the present time.

Still another Chemical Photometer.

There are several metals like uranium which are more or less sensitive to light when mixed with organic matter. The high degree to which silver possesses this character is well known. Dr. Eder, in Vienna, has studied the action of light on corrosive sublimate (mercuric chloride), and finds that it is easily reduced to calomel (mercurous chloride) in the sunlight. As the former substance is soluble in water and the latter is not, a white precipitate shows the change. It was found that the following proportions were the most sensitive: Dissolve 40 grammes of oxalate of ammonia in 1 liter of water (4 per cent) and 50 grammes corrosive sublimate (5 per cent) in 1 liter of water. Mix together 2 volumes of the former and 1 of the latter. In the red, yellow, and yellowish-green portions of the spectrum the solution remains clear, but is rapidly precipitated in the blue, violet, and ultra violet. The weight of the precipitate per minute is proportional to the photometric strength of the light.

The Largest of Land Animals.

In the *American Journal of Science and Arts*, Prof. Marsh describes the largest land animal yet known to have existed on the globe. Its name is *Atlantosaurus immanis*. The thigh bone of this creature is over 8 feet long, with a thickness at the larger end of 25 inches, though the bone has no true head. A comparison of this bone with the femur of a crocodile would indicate that the fossil saurian, if of similar proportions, had a total length of 115 feet. That the reptile was 100 feet long when alive is at least probable. The other bones of this animal that have been found are proportionately gigantic; caudal vertebra has a transverse diameter of more than 16 inches. All the bones of this reptile yet discovered are in the Yale College Museum. They are from the Upper Jurassic of Colorado.

A Fish Story.

A Boston correspondent of the *Forest and Stream* tells the following remarkable story. The scene is laid in Long Island, where, on the shore of a pond, the correspondent was watching the play of swallows as they skimmed just over the surface of the water shortly before sunset. "About a hundred yards out was a bed of lily pads; and as the swallows skipped it, occasionally a good sized ripple could be seen, and sometimes a break from the edges indicating a fish there. This fastened my attention to the particular place. I had often seen cats play with swallows, swooping at them, but the idea of fish doing the same was something new to me. Presently I saw a clean breach, and a fine large pickerel showed his whole size and got a swallow, too, as he disappeared beneath the water. This I saw repeated several times, and I called the attention of my companion to this novel sight. While we were watching we saw two large fish break at the same swallow, the fish coming from opposite directions, and each head on to each. Both missed the swallow, but, singular to relate, only one fish was seen to fall into the water, and neither was seen to pass the other. My companion and myself looked with wonder. There was a great commotion in the water with a continuous spattering, and a boat being handy we jumped in and rowed to the spot, and picked up the largest pond pickerel I ever saw. When we had him in the boat the mystery was solved; the smaller of the fish had, in his eagerness for the swallow, jumped clear down the larger one's throat, and only the tail, to the extent of about an inch, showed. The large fish was completely rent asunder and killed by the catastrophe. Both together weighed 22 pounds."

Two telephone companies have been chartered in Paris by the government, and are now connecting their central offices with the residences and offices of the subscribers. The company using the Edison telephone charge six hundred francs a year. The Société Générale de Telephones uses the Gower telephone, and charges one thousand francs per year. The government reserves the privilege of buying out both companies.

ELECTRICAL RAILWAY.

The electric railway illustrated in the accompanying engravings, which we take from *La Nature*, was exhibited at

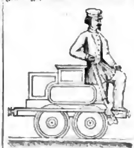
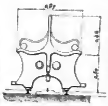


Fig. 1.—MOTOR.



END OF CAR.

the Berlin Exhibition of 1879. It presents a good example of the conversion of motive force into electricity and the conversion of the electric current back into motive force.

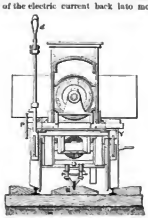


Fig. 2.—END VIEW OF MOTOR.

Two magnets or dynamo-electric machines, A and B, connected by metallic conductors, form a complete system for the transmission of power. If motion is imparted to the

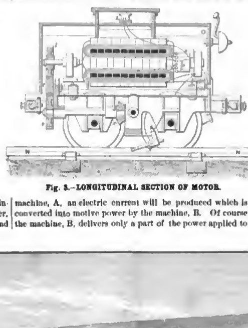


Fig. 3.—LONGITUDINAL SECTION OF MOTOR.

machine, A, an electric current will be produced which is converted into motive power by the machine, B. Of course the machine, B, delivers only a part of the power applied to the machine, A, and this amount of power transmitted varies with the nature of the machines, their speed, and the length of the conductors connecting them. Some machines are capable of delivering 60 per cent of the original power under favorable circumstances. A dynamo-electric machine operated by a steam engine, and connected by conductors with a second dynamo electric machine mounted on a vehicle, the wheels of which are acted on by the second machine, constitutes an electric carriage or wagon. If the vehicle be placed upon rails, and the rails are used as conductors, the current being taken from an insulated rail by a metallic brush and returned to the electric generator by the ordinary uninsulated rails, we have an electric locomotive; connect a few cars with this locomotive and we have the electric railway as constructed by Dr. Werner Siemens, the well known German electrician, and exhibited at Berlin.

In the annexed cuts Fig. 1 represents a side view of the locomotive and a cross section of the cars, both drawn to a scale of $\frac{1}{15}$. Figs. 2 and 3 show detailed views of the locomotive on a scale of $\frac{1}{5}$. Fig. 4 shows the locomotive drawing three cars, each containing six passengers. The machines used are of the continuous current system of Siemens. The armature is rotated by means of the current received through the conductors from the stationary machine, and transmits its motion to the driving wheels through a number of gear wheels, *l, t, c, x, y*, which are necessary to reduce the speed.

The machine producing the current has one of its poles connected with the track rails, and the other pole is connected with the insulated central rail, N (Figs. 2 and 3), which is simply a conductor. A pair of brushes made of very fine copper wire, like the collectors of the Gramme machine, are kept in contact with the rail, N, completing the electrical communication between the rail and the machine. The current comes through the insulated rail, passes through the brushes, traverses the wires of the electric motor, and returns through the wheels and track rails.

The cars and the locomotive have an electrical connection through a copper wire. The sixteen wheels of the train form a perfect metallic communication between the locomotive and the rails for the return current.

The locomotive is started and stopped by a lever controlled by the driver sitting on the locomotive. The brake is operated in a similar way. The performance of the locomotive varies from 2 H. P. and a velocity of 6 feet per second, to 3½ H. P. and 12½ feet per second ($7\frac{3}{8}$ miles per hour), the train carrying eighteen passengers.

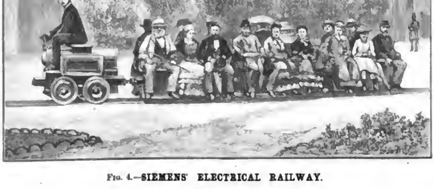


FIG. 4.—SIEMENS' ELECTRICAL RAILWAY.

MECHANICAL INVENTIONS.

Mr. Alfred H. Crockford, of Newark, N. J., has patented an improved brace for bits and drills of all kinds, whereby the bits and drills may be centered and firmly secured in the brace. The bits can also be readily applied to work in places or positions where the brace stock cannot have full swing.

An improved paper machine has been patented by Mr. William E. Phelps, of Lewisville, Pa. The object of this invention is to strengthen the paper by laying the fibers in all directions, instead of in the direction of the length of the paper only, as is now done.

Mr. Elijah Ware, of Omaha, Neb., has patented an improved spring power for watches and clocks. The object of this invention is to construct a spring power mechanical movement for use in watches and clocks, or for other purposes, where a small power is required, and to dispense with the train of gearing usually required. The inventor makes use of a spring attached to and coiled around a shaft that carries a loose and fast gear wheel, the spring being attached also to the loose gear, and the two wheels geared to a secondary shaft.

Mr. James A. Moore, of Kewanna, Ind., has invented a spring-propelled carriage, whose motive power is contained in a combination of coiled springs, levers, eccentrics, etc. These are so arranged upon a carriage as to be capable of exerting sufficient force after the springs are wound up to effect a long continued and economical propulsion of the carriage.

Improvements in pressing machines for printers, bookbinders, etc., have been patented by Mr. Joshua W. Jones, of Harrisburg, Pa. The object of this invention is to improve the construction of the machines for which letters patent Nos. 204,741 and 212,947 were granted to the same inventor June 11, 1878, and March 4, 1879, respectively, and which were illustrated in these columns some time since.

Mr. Ebenezer R. Gay, of Dubuque, Iowa, has patented a

relishing or tenon finishing machine for use on rails for doors, blinds, panels, or other woodwork having rails with tenons and a groove or rabbet for panels. In such work, when the groove is not as wide as the tenon is thick, or does not have the same face as the tenon, a rib or projection is left, which has to be removed, and the improved machine is adapted for such operation.

In a movement for watches and clocks patented by Mr. Elijah Ware, of Omaha, Neb., the object is to dispense with the train of gearing generally employed in clocks and watches, and thereby simplify the construction and reduce friction. This movement cannot be clearly explained without engravings.

Mr. William Forshaw, of Chicago, Ill., has patented an improved platform for vehicles. The invention consists of a forked standard, whose lower end embraces the axle at its center, while its head supports the bolster plate; and secured between the forks of the standard and projecting laterally therefrom in both directions is a plate spring parallel with and above the axle, and connected at its ends with the axle by transverse elliptical springs that are secured to the axle near its shoulders, and it further consists of a device for supporting and a device for adjusting the elevation of the carriage pole.

A lawn edge mower, patented by Mr. Timothy Hanley, of Boston Highlands, Mass., is an improvement on the lawn-edge mowers for which letters patent No. 220,899 were granted to the same inventor, October 21, 1879. With the improvements they may be used for mowing both high and low edges, as may be required.

An improved machine for making eyebolts has recently been patented by Messrs. Richard H. Briggs and James H. Dougherty, of Whistler, Ala. The objects of this invention is to provide an improved machine that may be operated by hand or other power for the manufacture of eyebolts of any required dimensions.

Mr. Josephus T. Willis, of Mount Sterling, Ala., has patented a device for instantly detaching horses from vehicles. It consists of levers, sleeves, pivoted trace hooks, and a helical spring arranged upon a whiffletree and operated by pulling upon the governing strap.

George Wharton Simpson.

Mr. George Wharton Simpson, the proprietor and editor of the London *Photographic News*, died suddenly at his residence, Rose Lawn, Catford Bridge, Kent, on the 15th January last. His life, for many years past, had been devoted to the study of photography and its literature, and the history of the *Photographic News*, as that journal very justly observes, is practically that of the deceased gentleman.

Mr. Wharton Simpson was the author of many well known works connected with photography. The "Year Book of Photography" is probably the most important of all, of which an edition has annually appeared since 1859. "On the Production of Photographs in Pigments" is the title of a historical and practical treatise of carbon printing published in 1867, which is of value to this day; nor must we omit to mention an important contribution to the history of the photographic art published in the *British Quarterly Review*.

As a successful experimentalist, he has left his mark. He early predicted a great future for collodion, and worked for many years to improve this material as a vehicle for silver salts. About 1857 he undertook an exhaustive research upon collodions sensitized with bromine salts, and strongly advocated the use of these in conjunction with iron development, as against iodized collodion with pyrogallic development. In later years he brought forward the well known collodio-chloride process, or Simpsontype, as it has been called in America. The collodio-chloride process may be termed the most permanent silver printing process we have, since the collodion film permits of more thorough washing than the albumen film. Strange to say, although the Photographic Society awarded its silver medal to Mr. Simpson for the work, it was in Germany, France, and America where the process found most favor, and where collodio-chloride paper was generally manufactured.

Finally, Mr. Simpson, we believe, enjoyed the reputation of being the only Englishman who has produced color by photographic printing. In experimenting with his collodio-chloride, he found one day that a portion of the material covered with ruby glass had become red under the action of the sun, the explanation, no doubt, being that the chloride in suspension had been changed by light to the violet sub-chloride, which had reproduced the tint of the glass above. The colors produced in photography by Niepce de St. Victor were secured, it is well known, by a similar use of what has been termed, for want of a better name, the violet sub-chloride of silver.

Mr. Wharton Simpson has served as vice president of the Photographic Society, and of the South London Photographic Society since its commencement, and his ability, both in the world of literature and photography, placed him in a prominent public position for many years past.

Captain Minie.

The death is announced, at Paris, of Claude Etienne Minié, the inventor of many important improvements in fire-arms. Born in Paris about 1805, as soon as he was old enough M. Minié enlisted in the French army as a private, and served through several campaigns in Algeria. Promoted to a captaincy of chasseurs, he devoted himself to inventing improvements which would perfect the infantry service. Favored with the special protection of the Duke of Montpensier, he was able to secure the adoption of various improvements, which affected the shape and make of balls, cartridges, and gun barrels. He was decorated in 1849, and in 1853 made chief of a battalion of horse. M. Minié refused to go to Russia and apply his inventions there, although offered still further promotion. He was long in charge of the shooting gallery at the Normal School at Vincennes, and contributed largely to the perfection of portable arms. In 1858 he was invited by the Pasha of Egypt to go to Cairo and direct the manufacture of arms and a school of shooting there.

General Arthur J. Morin.

A Paris report of February 7 announces the death of Gen. Arthur Jules Morin. General Morin was born October 17, 1795, and entered the Foot Artillery of the French Army some time after attaining his majority. He became a General of Division in 1855, and was afterward made Director of the Conservatory of Arts and Trades. He was well known to the scientific world, having published many works connected with experimental mechanics, and aided largely in the advancement of that science in France. He was admitted to the Academy of Sciences in 1843, and in 1858 was made a grand officer in the Legion of Honor. General Morin was President of the Imperial Commission for the Exhibition of 1855, and in 1862 was made President of the Society of Civil Engineers of France.

Death from an Electric Shock.

An accident of an extraordinary nature occurred on Tuesday night, January 17, 1879, at the Holte Theater, Aston, a suburb of Birmingham. The stage is lighted by two electric lights, and when the candles are not burning, the connections used for the purpose of crossing the current are hung up over the orchestra. After the performance of the pantomime, Mr. Bruno, the euphonium player, was leaving with the other members of the band, when, presumably out of curiosity, he caught hold of the two brass connections referred to; the man in charge called out to him with the object of warning him of the danger he was incurring. The warning, however, came too late; Mr. Bruno received the full shock of the electric current, generated by a powerful battery which supplies the whole of the lamps in the building and grounds. It is said that the candles not being then burning Mr. Bruno was unable to disengage himself, and pulled the wire down. The shock rendered him insensible. A medical man was at once sent for, and restoratives were applied, but Mr. Bruno died in about forty minutes afterwards.—*The Electrician*.

MISCELLANEOUS INVENTIONS.

Mr. James Alfred Roberts, of Sydney, New South Wales, Australia, has invented an improvement in carriage lamps, which relates to the candle tubes of the lamps. The object of the invention is to facilitate the insertion of the candle into and its removal from the candle tube.

Mr. William H. Hawes, of New York city, has devised a pigeon trap, so constructed as to prevent the birds from remaining in the trap after the trap is sprung. The invention consists in combining a semi-cylindrical box, a middle pivoted cover, and a cord, arranged so that as the cover is tipped it will force the birds from the semi-cylindrical box.

Mr. John W. Smith, of Jersey City Heights, N. J., has patented a bunker for holding ice in markets, hotel provision rooms, vessels, and other places where a room is to be kept cool. It is so constructed as to effect a great saving of ice, while keeping the room cooler than the ordinary bunkers.

Mr. Francois Raymond, of Woodhaven, N. Y., has patented a new and improved folding bed, which is simple in construction, durable, and convenient.

Mr. Charles H. Cushing, of Tidioute, Pa., has invented an improved device for adjusting or locking and unlocking the plug of a stop cock. The plug may be firmly held in any desired position against any pressure of the liquid contained in the pipe to which the cock may be attached, and all wear on the plug or on its seat in the body may be compensated for by slightly turning down a nut.

Mr. Abram V. S. Hicks, of Rockville Center, N. Y., has patented an improved combined hammock and supporting frame. This invention is an improvement in the class of beds formed of a folding frame and a hammock attached thereto. It consists in the peculiar construction and arrangement of the parts of the frame.

An improved book holder, patented by Mr. John L. Highbarger, of Sharpsburg, Md., is designed for holding books open for convenience of reading. The device is applied to the upper end of a book cover; and it consists mainly of three parts—a bar or roller, two hooks or clasps, and two bent pivoted fingers. The hooks and fingers are attached to the ends of the bar or roller, and receive and tightly clamp the upper edges of the lids of the book, and are so attached to the bar that it is free to rotate. The pivoted fingers revolve with the roller, so that they may be turned into suitable position to enable them to hold the leaves of the book.

Mr. William Driscoll, of Brockville, Ontario, Canada, has patented a trap, which is an improvement upon the form of animal trap in which the weight of the animal is made to release a tilting platform and allow the animal to be precipitated into a tank of water, a barrel, or other receptacle placed beneath the trap. In this form of trap it has been a desideratum to secure a latch mechanism for locking the platform which is sufficiently sensitive to be tripped by small animals, like mice, as well as by rats or larger animals. This improvement aims at this result.

Mr. Henry L. Russell, of Bloomington, Ill., has invented an improved device for attachment to the leaders that conduct the rain water from the eavestroughs to the cisterns. It is so constructed as to adjust itself automatically to conduct the first water from the roof into the waste pipe and the succeeding water into the cistern, to prevent the coal dust and other dust that may settle upon the roof from being washed into the cistern.

Mr. Joseph W. Price, of Bryan, Ohio, has patented an improved bed bottom, which is so constructed that the cord or wire can be easily and conveniently tightened, and easily put in and taken out.

A bucket for taking bees from the hives to arrange the comb, for carrying them from one place to another, and for capturing bees in case of swarming on trees, has been patented by Gideon C. Finley and Sarah E. Finley, of Petersburg, Tenn. The invention consists in a bucket for transporting and capturing bees, having openings for the entrance and exit of the bees, an apron before the entrance slide, and openings for ventilation. The bucket is so arranged that it can be pulled to the top of a long pole if desired.

A carriage body, which is so formed that it may be extended to form a two-seated carriage, or contracted or folded to form a single-seated carriage, as may be required, has been patented by Mr. Horace C. Seely, of Philadelphia, Pa.

Messrs. Charles Holzner and Fred. Vohringer, of Louisville, Ky., have patented an improved coal hod. The invention relates to the manner of securing the base ring, bottom, helmet, and funnel or nose of a hod to the body thereof. This is done by crimping and wiring the parts together.

A simple, convenient, and inexpensive refrigerator crate for transporting butter, fruits, meats, game, etc., has been patented by Mr. George W. Freeman, of Amboy, Ill.

Mr. James M. Davis, of Knobel, Ark., has patented improvements in irons for connecting the traces with the hames, the object being to permit the pressure on the horse's shoulder to be shifted when necessary to avoid irritation, and also to lock the traces in the hooks attached to the hames.

Messrs. James Stroud and Oliver C. Titus, of New York city, have patented an improvement in wickets used on doors, especially in prisons or asylums, which have heretofore consisted simply of a barred opening. The object of this invention is to construct such wickets with doors or flaps, whereby they can be closed tightly and fit the wicket flaps in such a manner that they can be opened only from one side.

Mr. Ira D. Bush, of Detroit, Mich., has patented a door bolt, which is so arranged that it can operate like an ordinary door bolt, and will also hold the door when it is opened a distance equal to the length of the bolt.

A key-board attachment for musical instruments, patented by Mr. Christopher C. Reynolds, of Kelseyville, Cal., is to be used in connection with prepared music sheets to play the instrument by turning a crank, or by attachment to any suitable motor.

Mr. James M. Thayer, of Randolph, Mass., has patented a cheap, simple, convenient, and effective buckle for ties for bags. The invention consists of a rectangular frame of metal, perforated on one side for attachment to a strap, the frame having pivoted within it a tongue with a beveled serrated tip, and curved or rounded end bars for the strap to hold or engage against.

Messrs. Robinson Buckingham and Charles W. Poindexter, of Alto Pass, Ill., have patented an improved packer, designed to facilitate the pressing into boxes or packages of fruits and vegetables—as, for instance, peaches, early apples, pears, plums, or other fruit that will stand pressure when packed, or green peas, string beans, sweet and Irish potatoes, tomatoes, and other vegetables. The machine used for that purpose presses the fruit or vegetables by the lid into the box or package, and admits the convenient and quick nailing of the lid while being held on the box.

The First Stocking-Knitting Machine.

To the Editor of the Scientific American:

In an article in your paper (No. 9, vol. xlii.) it is stated that the first machine for knitting stockings by power was made by a man in Albany, N. Y., who, in 1831, succeeded in converting a common hand frame into one of that kind. This, if you will consult the records of the Patent Office, you will find to be a mistake, as a patent was granted to John Bazin, Jr., of Canton, Mass., dated October 28, 1814, for a machine for knitting by power. This was the first stocking machine ever made in this country, and was truly an original invention, the inventor not having seen any kind of machine for that purpose until long after he had completed his. One of these machines, which was in operation during the years 1815 and 1816, is still in existence, and, though somewhat damaged by want of proper care on the part of those who have had it in charge, could very easily be put to working order by a competent mechanic.

There were never more than four of these machines built, as some capitalists, who had bought the right to use them in a distant country, by trying to obtain control of the whole patent, not only lost all they had spent in the business, but succeeded in preventing the patentee from deriving any benefit from his invention.

J. A. B.

Canton, Mass., February 10, 1880.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

The Edson Recording and Alarm Gauge, made and sold at 91 Liberty St., New York, causes a gong to ring in office and engine room when over-pressure occurs; and gives written "charts" of all pressure carried, whether of air, steam, or water. Used in breweries, paper mills, hotels, city water works, charitable and educational institutions and upon steamers, ferryboats, private yachts, and lighthouses. See card, with illustrations, in February number of Export Edition, under "Business Cards."

National Steel Tube Cleaner for cleaning boiler tubes. Adjustable, strong, durable. Chalmers-Spence Co., 40 John St., N. Y.

Wanted.—A good second-hand Pile Driving Engine. Address S. L. Wiley, Greenfield, Mass.

Wanted.—An Oil Mill of the most improved pattern, for the manufacture of cotton seed oil from the seed of the Sea Island cotton. State price and terms. Address Spirit of the Times, Jasper, Fla.

For Sale, in one lot, cheap, 250 "Mead" Sewing Machines, without stands. Apply P. O. Box 596, Montreal, Canada.

For Sale.—The large factory building, at Marion Station, on the Pennsylvania Railroad, in Jersey City, formerly occupied by the United States Watch Co., together with the boilers, engine, shafting. The premises comprise three acres, inclosed by iron fence. Building 330 x 71, wing, 40 x 90. Apply to Jas. A. Alexander, No. 2 Cortlandt St., New York city.

A thoroughly practical mechanic desires to correspond with a firm in want of a draughtsman, who can design, construct, and execute. Has had many years' experience in improved steam power millwork, and special tools. Address J. C. D., Box 773, New York.

Carré's French Cylindric Carbons for Electric Lights; assorted sizes, imported and for sale by C. Bacon, 216 Front St., New York city.

New Tubular Boiler, about five H. P., for sale cheap. Address W. N. W., Box 773, New York.

Scroll Saws; cheapest and best. D.S. Abbott, Olean, N.Y.

H. W. Johns' Asbestos Liquid Paints are strictly first-class pure linseed oil paints, and contain no water. They are the best and most economical paints in the world for structural purposes. H. W. Johns M'f'g Co., 87 Maiden Lane, sole manufacturers.

For Wood-Working Machinery, see illus. adv. p. 125.

Competent man wanted understanding wire rope conveyors for lumber, coal, etc. Address Rathbun & Co., Oswego, N. Y.

Steel Name Stamps, 15 cents per letter; steel figures, $4 per set. C. L. Anderson, Cleveland, Ohio.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 125.

Wanted.—A few sober, industrious Machinists and Moulders. Address H. B. Smith Machine Co., Smithville, Burl. Co., N. J.

New Inventions examined and tested. Designs and improvements. Reports for investors. Recipes and information on all industrial processes. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Chase's Pipe Cutting & Threading Machine. Send for circular. Chase Machine Co., 120 Front St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 9 cents per pound. Fully warranted.

Ice Machines selected. Information on all kinds. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Special Tools for Railway Repair Shops. L. B. Flanders Machine Works, Philadelphia, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 125.

The "Fitchburg" Automatic Cut-off Horizontal Engines. The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv., p. 62.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Blake's Belt Studs. The most durable fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

The Horton Lathe Chucks; prices reduced 25 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$40 Vertical Engine, 20 H. P. See page 125.

Emery Wheels of all kinds, and Machines at reduced prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 45.

Patent Steam Cranes. See illus. adv., page 125.

Nellis' Cast Tool Steel. Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

Best Turkey Emery in bbls., kegs, and cases. Special rates for large quantities. Greene, Tweed & Co., N. Y.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 125.

Deoxidized Bronze. Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Renshaw's Ratchet (short spindle) uses taper and square shank drills. Pratt & Whitney Co., Hartford, Ct.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

Catechism of the Locomotive. 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 126.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Solomon's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

The Twiss Automatic Cut-off; also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

J. P. Tallant, Engineer, Burlington, Iowa, makes a specialty of saving fuel and increasing power of defective boilers and engines.

Mica in sheet and scrap for sale in quantity to suit. Parties using Mica in any form please send for samples. Atlanta Land and Mining Co., Box 2792, Leadville, Col.

A No. 6 Root Blower, steel shafts of extra strength, and used less than four months, in good order. Charles L. Oudesluys & Son, 6 Exchange Place, Baltimore, Md.

Portable Forges, $18. Roberts, 107 Liberty St., N. Y.

For Sale.—Foundry and Machine Shop, third city in State; good business. Box 275, Winona, Minn.

Hydraulic Jacks and Presses. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Steam Engine for sale very low. See advertisement on another page.

A Rare Chance.—We have on hand a 40 H. P. Horizontal Oscillating Engine, built for special work, but never used. It is first-class in all respects; has patent guides to prevent wear; has balance wheel, but no pulley. Price $800. Reald, Sisco & Co., Baldwinsville, N. Y.

Campbell's Self-acting Window Shade Rollers are the best in the market. Models and terms to the trade. 95 Centre St., New York.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages. New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $30. Attached to any instrument. T. Shaw, 915 Ridge Ave., Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Collection of Ornaments.—A book containing over 2,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 110.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 94.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 45.

NEW BOOKS AND PUBLICATIONS.

THE ALIENIST AND NEUROLOGIST. Quarterly, Vol. I. No. 1. Edited by C. H. Hughes, M.D. St. Louis: Ev. E. Carreras. Price $5 a year.

This journal of scientific, clinical, and forensic psychiatry and neurology, is intended especially to meet the wants of the general practitioner of medicine. Its fundamental idea is that these departments of medical practice are parts of the trunk rather than special branches of medicine, and it will be devoted to the promulgation, among general practitioners of medicine, of sound teaching respecting the nature and treatment of neuro-psychic and nervous diseases, the proper management and care of the insane, and kindred matters. The initial number shows a good list of contributions by capable writers.

VISITOR'S GUIDE TO THE SMITHSONIAN INSTITUTION AND NATIONAL MUSEUM, WASHINGTON, D. C. Edited by W. J. Rhees. Washington: Judd & Detweiler. Paper, pp. 96. Price 35 cents.

Contains an illustrated description of the present building, and a cut of the new building; also a descriptive guide to the cases and objects displayed in the several departments of the museum.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) H. D. P. writes: In No. 21 of SCIENTIFIC AMERICAN of 1879, you give receipt for making ink to be used with copying pad. In the receipt occurs the symbols (2R B to 3 B). Please explain their meaning in making the ink. I have asked a great many who should know, but they cannot tell me. A. The terms 2B, 3B, etc., are technical expressions descriptive of certain grades or degrees of color, as bluish blue, blue blue, blue, etc.

(2) H. J. D. asks: 1. Will brass make a durable cylinder for a small steam engine (bore 3 inches, stroke 4 inches)? A. Yes. 2. Will Babbitt metal do to pack the piston head, melt and run it in? A. It could be done, but would remain tight but a short time. Cast iron rings would be better. 3. What size should the induction ports be for cylinder 3 x 4 inches? A. ⅜ by 1⅝ inches.

(3) E. N. J. writes: I am using stationary tubular boiler, 44 inches shell, 48 3-inch tubes, 12 feet long, fire passing underneath and returning through flues; have lined up fire box so that it is at least 4 inches narrower than the boiler. I claim that fire box ought to be at least 2 inches wider than the boiler to get the full benefit of our fuel, wood. Am I correct? If not, why? A. It is not necessary that the grate should be 4 inches wider than the diameter of the boiler, but the fire chamber above the grate should be at least 6 inches wider.

(4) G. H. S. asks if in the celebrated "Krupp one hundred ton steam hammer" the piston and hammer-head weigh together one hundred tons, and if so, is this the usual method of expressing the power of steam hammers. A. We suppose it to be the weight of the "tup," that is, hammer-head, piston, and rod, as the weight of steam hammers is generally spoken of in that way.

(5) C. L. H. asks: Can you give me any further instruction for making ink to use on the copying pad, in your SCIENTIFIC AMERICAN, No. 21? I have made some after that direction, as far as I understood it, and can get only about 10 fair copies; and by using ink furnished with other pads, can get 50 copies. Should be glad to receive any instructions you can give on the subject. A. You have probably used impure or improper aniline violet. Use pure 3 B methyl aniline violet.

(6) W. A. M. writes: I am desirous of building a steam yacht after the model of the one in SUPPLEMENT, No. 179, but propose to make it larger, 45 feet long by 10 feet beam. How many passengers will she carry, and what power engines will be needed? A. 18 to 22 passengers. 9 inch cylinder and 10 inch stroke.

(7) W. T. R. asks: 1. How can I prepare cyanide of silver for making a plating bath to use with a battery? A. Dissolve the silver in a small quantity of warm nitric acid. Evaporate nearly to dryness in a porcelain vessel, redissolve in pure water and add slowly solution (aqueous) of potassium until no further precipitate forms. Better decant the clear liquid, wash and dry the precipitated cyanide of silver. 2. Is chloride of gold used in its purity for a gilding solution? If not, please give directions for preparing it. A. No; use the cyanide of gold and potassium. 3. Will a gravity battery answer as well as a Smee for plating? I have been using it for plating some small articles, but have not had very good success. I prepared the solution by the battery process from silver coin. A. If properly managed, yes. 4. Is silver coin fit to prepare solution from or to use for anodes? A. Coin silver will not answer; it contains copper. 5. How much mercury does it take to operate a Sprengel air pump? A. From 20 to 50 lb. are commonly employed.

(8) W. S. B. asks: Is there any rule that will ascertain the pressure per square foot on a ship at different depths down its side? A. The pressure is 144 lb. per square foot for each 26 inches in depth, nearly. 2. Supposing a hollow tube could be plunged through the bottom of a ship, would the water rise and retain a position in the tube above the outside water level? A. No; it would rise to the height of the level of the water outside.

(9) J. K. writes: A states that the pressure of air necessary to keep the water from entering a diving bell is no greater at a depth of 300 feet than it is when the bell is only at a depth of 50 feet in the water. B states that on the contrary the greater the depth to which the bell is sunk in the water, the so much greater pressure of air is required to counterbalance the upward pressure of the water. Please state which is right, A or B. A. A is wrong. The pressure of air must be at least equal to the pressure due to the depth of water. B is right.

(10) W. E. K. asks how to take a large coal oil spot out of a carpet. A. Try benzole and woolen cloths.

(11) M. W. asks: 1. Is there any rotary engine equal in point of power to the best type of reciprocating engines? If so, who is the inventor and where is it manufactured? A. No. 2. Suppose a reciprocating engine turns 300 revolutions per minute, does it give any clearance? A. It must have some clearance to allow for the spring and play of the parts.

(12) H. D. writes: 1. I have an engraved copper plate which I wish to electroplate with steel. Can I do it, and how? A. Consult Gore's and Napier's Electro-metallurgies. 2. Can a Smee battery be used for the purpose? A. Yes.

(13) J. T. A. writes: There is a difference of opinion between a man and myself about a small steam boat as regards the government law. He says a small steam boat under five tons capacity has nothing to pay. I say they have to pay license and also inspection. A. You are right.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

M. F.—1. Mica schist with hornblende. 2. Syenite. 3. Zinc. 4. Red jasper. 5. Quartz, feldspar, and chalcopyrite. 6. Quartzose rock. 7. Sandstone. 8. Muscovite. 9. Sandstone. 10. Granite. 11. Quartz and trap. 12. Mica schist. 13. Limestone. 14. Chalcopyrite in talcose slate. 15. Gneiss and mica schist.

COMMUNICATIONS RECEIVED.

How to File the Champion Saw. By J. A. H.
On Limestone Built Cities. By J. S.
Five Sundays in February. By H. G. A.
On Inventions. By H. S. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 27, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Bedstead fastening, F. S. Clarkson	223,982
Beehive, E. H. Key	223,854
Belting, machinery for stretching leather, J. Brady (r)	9,069
Blacking box, J. Lamont	223,859
Blast furnace, P. L. Weimer	224,050
Blower or exhauster, jet, J. Zellweger	[illegible]
Boiler furnaces, air nozzle for steam, D. C. Cregier	223,841
Boot and shoe tree, P. Marsinjin	223,911
Box for holding embroideries, etc., W. Stander	223,956
Bretzel machine, H. Huber	223,917
Brush, rotary, J. G. Dinkelbihler	223,842
Brushes, manufacture of rubber backs for wire, A. C. Estabrook	223,844
Buckboard, Joubert & White	223,999
Butter washer, cooler, and worker, H. J. Lyman	223,934
Car brake and starter, J. L. Cole	223,995
Car, dumping, J. Jones	223,922
Car, oil tank, H. F. Snyder	223,967
Car, stock, S. Bray	223,978
Cars, mechanism for making ladder irons and hand holds for freight, Briggs & Dougherty	223,977
Carpet tacker, S. S. Grannis	223,905
Carriage top brace, C. Fockler	223,900
Caster, F. S. Clarkson	223,936
Caster, W. C. Coddington	223,839
Caster, O. Pederson	223,946
Caster, furniture, M. Fleet	223,916
Casting, flexible core for, T. Shehan	[illegible]
Cement and artificial stone, making, P. Ransome	223,815
Cereal, prepared, J. F. Gent	223,842
Chain, log carrying or bull, R. K. Gleason	223,904
Chain, ornamental, G. B. Whitney	223,971
Chandelier, extension, C. Deavs	223,901
Cheese bandage, B. W. Horton	223,915
Churn dasher, W. H. Brockman	224,079
Cider press, G. Ziegler	[illegible]
Coat hook, A. E. Taylor	223,962
Cock, automatic cylinder, G. P. Hammer (r)	9,064
Crayon compound, Ullman & Stiles	223,969
Cultivator, R. M. Root	223,804
Currycomb, W. G. Schaefer	223,964
Curtain fixture, M. Brown	223,878
Door hanger, A. N. Monfeet	223,941
Drums, jacket for shipping, J. H. Preston	223,949
Elastic rollers, composition for, J. Entbridge et al.	223,990
Electric machine, dynamo, S. D. Field	223,845
Electrical switch pin, J. H. C. Watts	223,969
Exercising machine, D. P. Butler	223,786, 223,199
Farm gate, J. S. Pedro	223,944
Faucet, T. F. Conklin	223,996
Feed water heater for steam boilers, E. Reynolds	223,916
File bill, J. P. Patterson	[illegible]
Firearm lock, T. G. Bennett	223,797
Flush tank, G. E. Waring, Jr.	223,836
Folding chair and settee, G. W. Chamberlin	223,990
Grain binder, P. F. Hodges	223,905
Grain binder, A. S. Hoyt	223,832
Grain separator, magnetic, C. R. Fritz	223,901
Grazing post, T. B. Ashford	223,972
Grinding mill, middlings, J. Mills	223,806
Gear, stop motion, P. F. Hodges	223,906
Goods exhibitor, roll, S. T. Dickens	223,844
Guard finger, M. Howard	223,807
Harness gag runner, M. R. Dowlin	223,896
Harrow, rotary, W. W. Vanhorn	[illegible]
Harvester, W. F. Olin	223,812
Harvester, band binding, S. Johnston	223,978
Hay rake, Johnson & Parsons	223,922
Hinge, awning blind, T. O. Mesmery	223,937
Hinge, gate, J. K. Davis	223,880
Hoop coiling machine, A. F. Ward	223,969
Hoop lock cutter, H. A. & W. Tripp	223,924
Hop picking machine, S. D. Locke	223,854
Horse power, R. M. Beeben	223,875
Hydrant, S. A. Jenks	[illegible]
Hydraulic motor, J. A. Myers	223,843
Indicator lock, H. L. Russell	223,955
Inking apparatus, S. G. Ames	223,982
Jewelry, etc., ornamentation of, L. J. Falise, Jr.	223,901

Jointer and colter block, E. Allen .... 223,[illegible]
Key hole guard, F Canis .... 223,[illegible]
Kitchen table, cabinet, W. H. Wiester .... 223,[illegible]
Lamp, Kato & Chinnock .... 223,[illegible]
Lamp, electric, T. A. Edison .... 223,[illegible]
Lantern, R. Hammill .... 223,[illegible]
Lead fumes, refining, Lewis & Bartlett .... 223,[illegible]
Leather fastener, G. S. Miller .... 223,[illegible]
Lever, double-acting, K. Lambkin .... 223,[illegible]
Locomotive fire box, W. H. Rushforth .... 223,[illegible]
Lozenge cutting machine, W. R. Demant (r) 9,080
Lumber drying kiln, R. J. Randell .... 223,[illegible]
Lumber trimming machine, P. Musser 223,942
Mail bag fastener, D. R. Miller .... 223,[illegible]
Meat cutter, D. H. Lintner .... 223,[illegible]
Medicine for the treatment of diphtheria, L. L. Polk .... 223,[illegible]
Metals from ores, extracting, O. Hofmann .... 223,[illegible]
Middlings purifier, J. Russell .... 223,[illegible]
Middlings purifiers, traveling brush for, Reimers & Eierhauer .... 223,[illegible]
Millstone paint staff, W. Lehmann .... 223,[illegible]
Mincing machine, D. H. Lintner 223,909
Mitering machine, T. Schroeppel .... 223,[illegible]
Mower, lawn, F L. Cutter .... 223,[illegible]
Musical instruments, machine for perforating sheets of paper for automatic, R. T. Smith .... 223,[illegible]
Nickel, electro-deposition of, J. H. Potts .... 223,[illegible]
Nut lock, J. R. Hayes .... 223,[illegible]
Ore roasting furnace, H. Herrenschmidt .... 223,[illegible]
Paint, distemper, C. G. Dodge, Jr .... 223,[illegible]
Paper and pasteboard, method and apparatus for manufacturing, N. Kaiser .... 223,[illegible]
Paper bag machine, E. B. Stocking .... 223,[illegible], 223,[illegible]
Paper bag, satchel bottom, E. B. Stocking .... 223,[illegible]
Paper, etc., for wrapping silver and other metals to prevent them from tarnishing, preparing, J. C. Pennington .... 223,[illegible]
Paper pulp screen, B. F. Warren .... 223,[illegible]
Pigment bases, manufacturing, Lewis & Bartlett .... 223,[illegible]
Pile driver, J. Hoy (r) .... 9,[illegible]
Pipe coupling, D. Boyle .... 223,[illegible]
Pistol rest, I. Kinney .... 223,[illegible]
Pitman connection, J. Russell .... 223,[illegible]
Plaiting machine, J. E. Chenette .... 223,[illegible]
Planing machine, wood, L. P. Hoyt .... 223,[illegible]
Plant protector, T. Delany .... 223,[illegible]
Planter, hand corn, C. D. & O. J. Boehmer .... 223,[illegible]
Planter, seed, S. P. & R. J. Wentz .... 223,[illegible]
Planters, check row attachm't for corn, J. Stoiber .... 223,[illegible]
Planters, check rowing attachment for corn, J. W. Cornell .... 223,[illegible]
Plow, gang, Armstrong & Murcheson .... 223,[illegible]
Plow, sulky, I. Burke .... 223,[illegible]
Power, apparatus for transmitting, J. L. Scott .... 223,[illegible]
Pressure regulator valve, J. Danby .... 223,[illegible]
Printing, autographic, J. J. Bardwell .... 223,[illegible]
Propeller, reciprocating, J. W. Capen .... 223,[illegible]
Puddling and heating furnace, W. Stubblebine .... 223,[illegible]
Pulley, clothes line, D. C. & J. H. Payne 223,947
Pulverizer, soil, J. Lafeber .... 223,[illegible]
Pump, mining, W. E. Harris .... 223,[illegible]
Rail joint, W. W. Fay .... 223,[illegible]
Reservoir, hot water, D. R. Rice .... 223,[illegible]
Rock drill, J. G. Cranston .... 223,[illegible]
Rubber or other gum cloth and compositions thereof, manufacture of, G. Y. Beach .... 223,[illegible]
Ruling machine, paper, W. O. Hickok et al. .... 223,[illegible]
Saddle tree, side, J. Eberle .... 223,[illegible]
Sand band, S. Marsh .... 223,[illegible]
Saw mill log conveyer, C. D. Meigs .... 223,[illegible]
Sawing machine, band, G. M. Van Riper .... 223,[illegible]
Sheave, E. D. Draper .... 223,[illegible]
Shoe holder, J. C. Stoddard .... 223,[illegible]
Snap hook, G. D. Mosher .... 223,[illegible]
Soldering iron, J. J. Henry .... 223,[illegible]
Soldering tin cans, apparatus for, D. Palmer .... 223,[illegible]
Soldering tool, D. Palmer .... 223,[illegible]
Spinning frame bobbins, yarn fastener for, J. W. Cummock .... 223,[illegible]
Spinning machine, Schoch & Keller .... 223,[illegible]
Stamp, branding, A. S. Gear .... 223,[illegible], 223,[illegible]
Stamp mills, ore feeder for, I. B. Hammond .... 223,[illegible]
Stamp, ore, H. H. Taylor .... 223,[illegible]
Steam generator and superheater, J. B. Ward .... 223,[illegible]
Steering apparatus, steam or hydraulic, J. Gates .... 223,[illegible]
Stove, A. J. Redway .... 223,[illegible]
Stove, coal oil cooking, W. H. Wiester .... 223,[illegible]
Telegraph line, underground, A. B. Turner .... 223,[illegible]
Thill coupling jack, E. Miller .... 223,[illegible]
Thrashing machine, G. Holcomb .... 223,[illegible]
Time lock unlocking attachment, S. M. Lillie .... 223,[illegible]
Torpedo boat, W. H. Mallory .... 223,[illegible]
Towel rack, J. R. Roberts .... 223,[illegible]
Toy watch, B. J. Clay .... 223,[illegible]
Truck, safety car, S. L. Skinner .... 223,[illegible]
Tube expander, H. H. Collins .... 223,[illegible]
Tug hame, M. L. Haughton .... 223,[illegible]
Valve for engines, distribution and expansion, R. Affeltranger .... 223,[illegible]
Vapor burner, Wallace & Davis .... 223,[illegible]
Vehicle brake, F. J. Wenker .... 223,[illegible]
Violin, T. Howells .... 223,[illegible]
Wagon, dumping, L. Rodenhausen .... 223,[illegible]
Wagon running gear, J. J. Du Bois .... 223,[illegible]
Wash stand, O. Hammerstein .... 223,[illegible]
Washing machine, U. Miller .... 223,[illegible]
Water elevator, compressed air, T. B. Keating et al. .... 223,[illegible]
Water heater, W. H. Hinsdale 223,911
Water motor, W. Lay .... 223,[illegible]
Weather strip, W. J. Anderson .... 223,[illegible]

DESIGNS.

Carpet, T. J. Stearns .... 11,[illegible]
Medallions, H. Knubel, Jr. .... 11,[illegible]
Torches, J. M. Adams .... 11,[illegible]
Woven fabrics, E. Maertens .... 11,[illegible]

TRADE MARKS.

Cigars, J. R. Smith .... 7,[illegible]
Flour, H. Koch .... 7,[illegible]
Turpentine in cans, cases, or barrels, spirits of, Blossom, Hayne & Co. .... 7,[illegible]
Whisky, D. F. Clemmer .... 7,[illegible]

English Patents Issued to Americans.

From January 23 to January 27, inclusive.

Coloring fibrous materials, H. W. Vaughan, Providence R. I.
Electric light, E. J. Houston et al., Philadelphia, Pa.
Grain binder and gatherer, M. A. Keller, Brockport, N. Y.
Ice manufacture of, A. J. Rossi, New York city.
Lamp, C. S. Westland, Providence, R. I.
Propelling vehicles, C. L. French, Brooklyn, N. Y.
Spinning machinery, Wm. Clark et al., Newark, N. J.
Telegraph, electric, W. C. Barney, New York city.
Telephone signal apparatus, G. H. Bliss, Pittsfield, Mass.
Valve, slide, K. Robinson, Columbus, Ohio.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

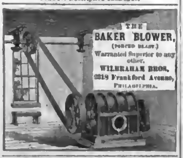
The Rodier Patent Single Iron Plane.

Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

FRIEDMANN'S PATENT INJECTOR,
The best

BOILER FEEDER

In the world.
Simple, Reliable, and Effective.
40,000 IN ACTUAL USE.
NATHAN & DREYFUS,
Sole Manufacturers, *NEW YORK.*
Send for Descriptive Catalogue.



The New York Ice Machine Company,

21 COURTLANDT STREET. ROOM 54.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more Ice. Uses only ¼ water of condensation. No Pressure at rest. Pressure in running, 24 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

OUR CATALOGUES, illustrated and priced, of Microscopes, Telescopes, Opera and Field Glasses, Thermometers, Barometers, mailed free to any address. R. & J. BECK, Manufacturing Opticians, Philadelphia, Pa.

COLUMBIA BICYCLE.
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of The Bicycling World.
THE POPE M'F'G CO.,
89 Summer Street, Boston, Mass.

BOILER COVERINGS.

Plastic Cement and Hair Felt, with or without the Patent "AIR SPACE" Method.

ASBESTOS MATERIALS,

Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John Street, and Foot of E. 9th Street, New York.

BRASS AND COPPER TUBES,
SEAMLESS & BRAZED.
MERCHANT & Co. PHILADA.

TRY

THE LEHIGH EMERY WHEEL.

For catalogue and prices, address
LEHIGH VALLEY EMERY WHEEL Co.,
WEISPORT, PENNA.

SHEPARD'S CELEBRATED
$60 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO.,
331, 333, 335, & 337 West Front Street,
Cincinnati, Ohio.

Holly's Improved Water Works.

Direct Pumping Plan. Combines, with other advantages, over older systems, the following: 1. Secures by variable pressure a more reliable water supply for all purposes. 2. Less cost for construction. 3. Less cost for maintenance. 4. Less cost for daily supply by the use of Holly's Improved Pumping Machinery. 5. Affords the best fire protection in the world. 6. Largely reduces insurance risks and premiums. 7. Dispenses with fire engines, in whole or in part. 8. Reduces fire department expenses. For information by descriptive pamphlet, or otherwise, address the
HOLLY MANUFACTURING CO., Lockport, N. Y.

Will be mailed free to all applicants, and to customers without ordering it. It contains four colored plates, 600 engravings, about 200 pages, and full descriptions, prices and directions for planting 1500 varieties of Vegetable and Flower Seeds, Plants, Roses, etc. Invaluable to all. Send for it. Address,
D. M. FERRY & CO., Detroit, Mich.

Gear Molding without Patterns

Scott's Gear Moulding Machines,

AIR COMPRESSORS & ROCK DRILLS.

DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
FOOT OF W. 13th ST., North River, NEW YORK.
ESTABLISHED 1841.

STEAM HEATING APPARATUS

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
235 BROADWAY, NEW YORK.

For Young or Old.

Do Your Own Printing.

$3 Press for cards, envelopes, etc. 14 other sizes, $8, $11, $25, $44, etc. Type setting easy by printed instructions. Do your own printing and advertising. Money made fast in any place publishing or running a paper. Catalogue of Presses, Type, Cards, etc., for 2 stamps. Kelsey & Co., Man'f'rs, Meriden, Conn.

The George Place Machinery Agency

Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

BOYLE ICE MACHINE CO.,
10 N. Jefferson St., Chicago, Ill.
The best Ice and Refrigerating Machines of all sizes and for all purposes guaranteed. Send for circular.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29 ST. NEW YORK CITY.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

SAWING THE LOG.

THE GREAT SUCCESS OF THIS WONDERFUL IMPROVED Labor Saving **GIANT RIDING SAW MACHINE** is fully demonstrated by the number in use and the present demand for them. It saws Logs of any size. **One man can saw more** logs or cord wood in one day and **easier** than two men can the old way. It will saw a two foot log in three minutes. **Every Farmer needs one.** Township agents wanted. Send for Illustrated Circular and Terms.
Address W. W. BOSTWICK & CO.,
178 Elm St., Cincinnati, O.

CAUTION.—Beware of all imitators and infringers. We own five perfect patents on these Giant Riding Saw Machines. We warrant every Machine.

THE BEST THING YET. THE Fitchburg Acoustic Telephone Co.'s New Metallic Telephone. Send for circulars.
FITCHBURG ACOUSTIC TELEPHONE CO.,
Box 78, Old City, Fitchburg, Mass.

FOOT PRESSES.
STILES & PARKER PRESS CO., Middletown, Conn.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

THE SKINNER PORTABLE & STATIONARY ENGINES BOILERS & GOVERNORS
FIRST CLASS & ECONOMICAL. SKINNER & WOOD ERIE, PA.
SEE ILLUSTRATED ADVERTISEMENT

Shafts, Pulleys, Hangers, Etc.

Full assortment in store for immediate delivery.
WM. SELLERS & CO.,
79 Liberty Street, New York.

WATCHMAN'S IMPROVED

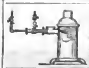
Time Detector, with Safety Lock Attachment. Send for circular to E. IMHAEUSER, 212 Broadway, P. O. Box 2875, New York. Beware of buying infringing detectors.

PERFECT

NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.



THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

ORGAN **BEATTY** PIANO
New Organs 13 stops, 3 set Golden Tongue Reeds, 2 Knee Swells, Walnut Case, warn'd 6 years, Stool & Book $98. New Pianos, $143 to $255. Newspaper sent Free. Address Daniel F. Beatty, Washington, New Jersey.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

THE PICTET ARTIFICIAL ICE COMPANY, Limited,
Ice Machines to make from 50 pounds per hour to 50 tons per day, at 22 Cortlandt St., New York. P. O Box 3083.

WOOD SOLE SHOES.
The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send for circular to
CHAS. W. COPELAND,
122 Summer St., Boston, Mass.

H. W. JOHNS' ASBESTOS STEAM PACKING,

In all sizes of rope.
ASBESTOS FLAT PACKING,
In sheets and gaskets, all sizes.
ASBESTOS WICK PACKING,
For small valve stems, etc.
Are ten times as durable as any others, and are indestructible by fire or acids.

ASBESTOS CEMENT FELTING

and AIR CHAMBER COVERINGS, for steam pipes, boilers, etc., are the most effective, durable, and economical non-conductors in the world. They can be readily applied by any one.
Send for descriptive price lists.

H. W. JOHNS M'F'G CO.,
Sole Manufacturers of Genuine Asbestos Materials,
87 MAIDEN LANE, NEW YORK.

PATENT
COLD ROLLED
SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburg, Pa.
190 S. Canal Street, Chicago, Ill.
☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass.
Geo. Place Machinery Agency, 121 Chambers St., N. Y.

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

Leffel Water Wheels,

With recent improvements.
Prices Greatly Reduced.
8000 in successful operation.
FINE NEW PAMPHLET FOR 1879,
Sent free to those interested.
James Leffel & Co.,
Springfield, O.
110 Liberty St., N. Y. City.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators,
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

$10,000 INSURANCE FOR 25 Cts.
ON LIFE & PROPERTY.
$10,000 will be paid to any person who can EXPLODE A LAMP fitted with our SAFETY ATTACHMENT. Mailed free for State. Agents Wanted, Male or Female.
R. E. NEWTON'S SAFETY LAMP CO.,
Binghamton, N. Y.
Salesroom, 13 West Broadway, N. Y.

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought

STRUCTURAL IRON.

It is believed that, were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished on application.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES
AND
AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL Co
SEND FOR PAMPHLET. FITCHBURG MASS.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

The J. L. Mott Iron Works,
88 and 90 BEEKMAN ST.,
Manufacturers of
DEMAREST'S PATENT
WATER CLOSETS.
Simple in construction, perfect in operation, thoroughly excluding all sewer gas, and cleanly in every way.

RARE CHANCE TO INVEST. WANTED, PARTNER with $4,000 or $4,500 in established business. Address J. R. McCORMICK, Georgetown, Texas.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements,
from 10 to 1,000 H. P.

BROWN'S PAT. SPLIT PULLEYS
Shafts, Hangers.
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

1880. 1880. 1880.

The Scientific American

FOR 1880.
THIRTY-FIFTH YEAR.

VOLUME XLII. NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Third day of January, 1880, a new volume was commenced. It will continue to be the aim of the publishers to render the contents of the new volume as attractive and useful as any of its predecessors.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

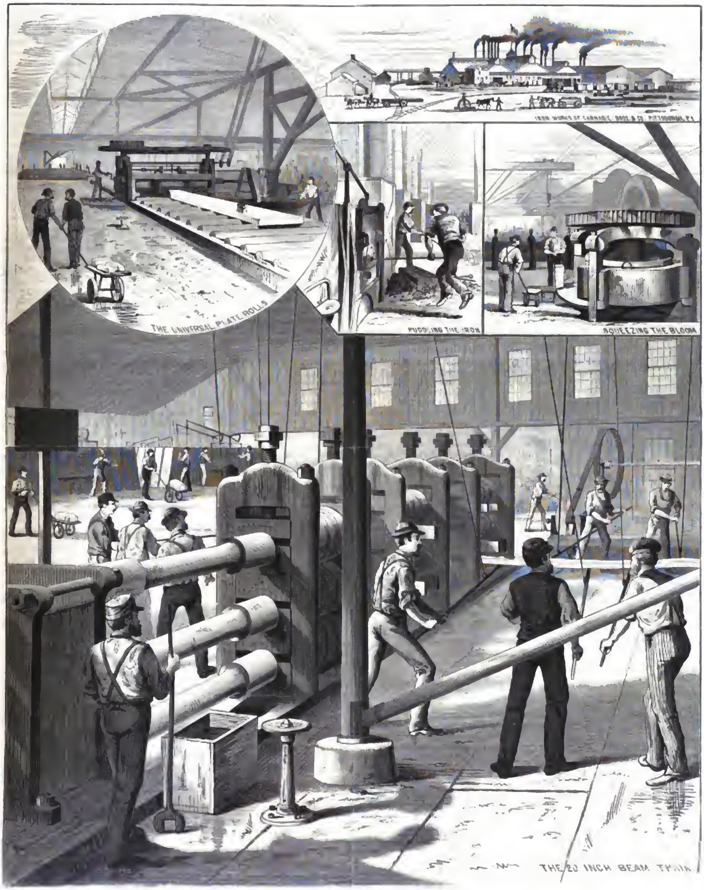
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 10. [NEW SERIES.] | NEW YORK, MARCH 6, 1880. | [$3.20 per Annum. [POSTAGE PREPAID.]



THE UNION IRON MILLS, CARNEGIE BROTHERS & COMPANY, PITTSBURG, PA.—[See page 149.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, MARCH 6, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 218,

For the Week ending March 6, 1880.

Price 10 cents. For sale by all newsdealers.

THE PROPOSED NEW PATENT LAW.

On the 9th February the committee on the Revision of the Laws of the United States House of Representatives, on a motion to suspend the rules, succeeded in rushing through that body a bill "To regulate the practice in suits brought to recover damages for the infringement of patents." The bill is a very different one from that which was so elaborately discussed previous to its passage by the Senate and defeat in the House last year, and, coming as it did from the Committee on the Revision of the Laws, instead of from the Committee on Patents, took everybody by surprise; it was passed without any consideration whatever, but few members understanding its provisions, and only 126 voting, when there are 293 members in a full house.

The extraordinary haste with which it was put through was such that, we understand, the bill had not even been printed when it passed the House. The official text is as follows:

AN ACT to regulate practice in suits brought to recover damages for infringement of patent.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That hereafter in any suit brought in any court having jurisdiction in patent cases for an alleged use or infringement of any patented article, device, process, invention, or discovery, where it shall appear that the defendant in such suit purchased the same in good faith for his own personal use from the manufacturer thereof, or from a person or firm engaged in the open sale or practical application thereof, and applied the same for and to his own use and not for sale, if the plaintiff shall recover a judgment for five dollars or less, as damages, the court shall adjudge that he pay all costs of suit; and if the plaintiff shall not recover the sum of twenty dollars or over, the court shall adjudge him to pay all his own costs, unless it shall also appear that the defendant at the time of such purchase or practical application had knowledge or actual notice of the existence of such patent: *Provided*, That nothing contained herein shall apply to articles manufactured outside of the United States.

Passed the House of Representatives February 9, 1880.

Attest: GEORGE M. ADAMS, CLERK.

It certainly seems very ridiculous, after the many years during which some of the ablest members of both Houses of Congress have been unsuccessful in perfecting a patent bill which would meet all objections, to pretend that *this* measure has been brought forward, and thus "railroaded" through the lower House, for the "protection of farmers" from the extortions of patentees, which is now the principal point urged in its favor. "Farmers" are not generally credited with having the influence at Washington which can accomplish such results, and the manner in which the bill was passed, as well as the promptitude with which this justification of its provisions is furnished, carry conclusive proof, if any were needed other than that afforded by the bill itself, that the work is only one other "neat little job" of a well-paid lobby. Already before those most interested have had an opportunity to judge of the merits of the bill, a leading New York daily has some cut-and-dried arguments to urge in its support, put in what is judged to be a popular way, which may be summarized as follows: That sharpers have succeeded in imposing upon many people—especially farmers—by selling them what the seller did not own, or had no right to sell; that the patent laws are complicated, and common people cannot be expected to understand them, and that, therefore, the patentee should help make good to an infringer any loss which the latter may suffer from throwing away his money on swindlers.

The foundation of our patent system rests only on the constitutional provision that "Congress shall have power to secure to inventors for limited times the *exclusive* right to their discoveries." Congress, at an early day in our history, enacted laws in pursuance of this provision, which, although they have been many times changed, have always retained this distinctive feature; they give to the inventor the "exclusive" right to his inventions. Congress may constitutionally enact that patents shall hereafter be "limited" to a year, or six months only, or may repeal the patent law entirely; but plainly any right at all which a patent gives must, according to the Constitution, be an "exclusive" one, and all patents so far issued have "secured" such exclusive right, so far as the law is concerned. This bill would destroy the inventor's exclusive right, for it makes the conditions so favorable for infringers, and bears so inequitably upon patentees, that it would be utterly impossible for thousands of the latter to maintain their rights. That ignorance of the law is never a bar to punishment for its violation runs through all our jurisprudence, and every man is expected to know what the law is; but here we are, it seems, to have an exception, in the case of a man who wishes to use a patent without paying the patentee, for which this bill practically offers a premium. Another constitutional objection is also to be found in that provision which prohibits the passage of any law "impairing the obligation of contracts." The inventor obtaining a patent obligates himself to do, and must perform, many things, often at great cost, in order to fulfill the conditions imposed, and the law says he shall have in return certain benefits; when the patentee has fulfilled the conditions, and invested large sums of money, under the rights with which he has been legally vested, to arbitrarily deprive him of the benefits would be practically a direct violation of this constitutional provision.

That there have been thousands of people swindled—not only farmers, but men of all classes—in buying articles manufactured by infringers of patents, cannot be denied. One would think that the remedy for this evil should be sought in legislation to more certainly detect and more effectually punish the criminal; but this bill cannot fail to act as a premium for those who have a turn for this sort of enterprise, as it virtually confiscates to their use the property of thousands of patentees. The law holds, in regard to all other kinds of property, that the purchaser is bound to exercise due care and discretion to see that the seller is the owner of or has the right to sell that which he offers, without which there can be no *bona fide* sale; but this bill not only relieves the purchaser of a patent from any obligation to exercise such care and diligence, but actually lays a fine upon the rightful owner for establishing his legal title in the courts. We do not for a moment believe that the bill in its present form can pass the Senate; but if it should be amended there, and go back again to the House, we trust it will then be fully discussed, with such ample explanation of its provisions as the great importance of the subject calls for; if this innocent measure "to regulate practice," etc., comes up again in this way, we shall have no fears of its being then rushed through so precipitately, notwithstanding the urgent reasons which the "Third House" may adduce for prompt action—on behalf of "the farmers," of course.

APPROXIMATE ECONOMY OF GAS AND ELECTRIC LIGHTING.

Taken by itself a cipher is an innocent thing and amounts to nothing; but its presence or absence in a series of figures sometimes makes an important difference in the summing of results. We presume that most of our readers must have noticed the errors resulting from the omission of ciphers in the article in our paper of February 21, under the above heading. As the subject is one of interest we think the best way is to republish the article, corrected as it should have been printed, and therefore give it as follows:

It is not in every place or position that the electric light can be employed in lieu of gas; but under some circumstances, for example, in spacious apartments, where large numbers of gas lights are used, the electrical method of lighting may now be adopted with satisfactory success. Under such conditions, and with gas costing the excessively high prices that we are accustomed to pay, the superior economy of electricity over gas has been conclusively settled on this side of the Atlantic. We might cite various examples, but for our present purpose one will be enough, to wit, the Riverside Worsted Mills, Providence, R. I., where the Brush electric lights have been in regular use for about one year past—long enough to determine approximately their actual expenses and merits.

In one portion of the above mills 1,000 gas lights were used, each of 15 candles intensity, yielding an aggregate of 15,000 candles, and costing $12.25 per hour to run them, or $\frac{82}{1000}$ of a cent per candle per hour.

We are not informed as to the exact cost of the gas per 1,000 cubic feet, but we figure it to be $2.45.

In lieu of the above 1,000 gas lights 80 electric lights were substituted, each of 2,000 candles intensity, yielding an aggregate of 160,000 candles, and costing 80 cents per hour to run them, or $\frac{5}{10000}$ of a cent per candle per hour.

If we have not been misinformed as to the above estimates of costs and intensities, it would appear that gas lighting, at the mills named, was over a hundred and sixty times more costly than electric lighting, quantity of light produced being considered.

It may not be uninteresting briefly to compare the probable economies of Mr. Edison's new system of lighting with the foregoing results.

Mr. Edison's method has, to be sure, as yet only reached the stage of experiments. But it must be remembered that his trials have been made on an extensive scale, with full-sized electrical machines and apparatus, expressly with a view to show and determine what the practical introduction of the invention, wherever used, would accomplish. We have his authority for saying that the generous sum of one hundred thousand dollars in cash was placed at his free disposal, by his associates, to be used as he saw fit for these grand experimental demonstrations.

In a word, Mr. Edison's plan is to furnish small electrical lamps, each having the intensity, he tells us, of an ordinary gas light of fifteen candles, burning five cubic feet of gas per hour. He states that he gets ten lamps, or 150 candles, of light per hour per horse power of engine; and that each of his new electrical machines furnishes 750 candles of light and requires five horse power to drive it.

Applying the Edison system to the Riverside Mills and to the replacement of the 1,000 gas lights, we have the following approximate results:

Number of Edison lamps required, 1,000; number of Edison machines required to run the lamps, 20; engine power needed, 100 h. p. Approximate cost of the Edison plant, $16,000. Approximate cost of running the same, delivering 15,000 candles of light per hour, including 6 per cent interest on the plant, $1.66 per hour, or $\frac{11}{1000}$ of a cent per candle per hour. This estimate allows no royalty to the owners of the patents. Thus the approximate cost of gas lights at the Riverside Mills is seven and a half times more than the same quantity of light would be under the Edison system. And the cost of the Edison system would, approximately, be twenty-two times more than the cost of the same quantity of electrical light as delivered by the present Brush machines. Side by side the fractions stand as follows:

Approximate costs of lighting per candle per hour:

Gas lights.	Edison lights.	Brush lights.
$\frac{82}{1000}$ of a cent.	$\frac{11}{1000}$ of a cent.	$\frac{5}{10000}$ of a cent.

THE CERTIFICATION OF TIMEPIECES.

At the recommendation of the board of managers of the Winchester Observatory of Yale College, the corporation of the college has established a horological bureau for the rating of watch movements and other timepieces, and the prosecution of researches calculated to aid in the construction of refined apparatus for the measurement of time.

For carrying on this work the bureau has been furnished with a large number of instruments of precision, and arrangements have been made with the Safe Deposit Company of New Haven for the erection within their steel vaults of the necessary apparatus and closets for safely keeping the watch and chronometer movements while being tested. These closets comprise a refrigerator (40° Fah.), provided with zinc cases for 100 movements surrounded by chemically dried air; an oven (90° Fah.) of equal capacity, heated by coils of pipe carrying hot water; and closets of ordinary temperature (65° to 75° Fah.), having a capacity of 800 movements.

Eight classes of certificates will be issued with timepieces which have been submitted for trial, stating in detail the results obtained with each particular movement. The cost of testing or certifying ranges between $1 and $4. While under examination the movements will be carefully guarded by the Safe Deposit Company. They are not to be opened or in any way tampered with for any reason whatever, and will not be handled except by trained observers.

First-class movements will be subjected while rating to variations of position and temperature as follows: Dial up; twelve days at ordinary temperatures, one day in the refrigerator, and one day in the oven. Dial vertical; fourteen days pendent up, two days pendent right, and two days pendent left. Dial down, two days. Dial up; eight days. The variations of rate under each of these conditions will be given in the certificate. For lower grade certificates the tests are less protracted.

The astronomer in charge of the bureau, Mr. Leonard Waldo, will supply blanks and information as to the conditions of issuing certificates; and in his annual report he will publish in detail the rates of such timepieces in the various classes as may show progress in the horological art.

The results of such work cannot fail to advance the standard of watch manufacturing. It will also enable watch buyers to know precisely what they are getting, an advantage which they will not be slow to appreciate.

IMPORTANT DECISION BY THE U. S. CIRCUIT COURT —THE PAGE ELECTRICAL PATENT SUSTAINED.

The suit of the Western Union Telegraph Company against the Holmes Burglar Alarm Company, has just been decided in the United States Circuit Court in this city, Judge Blatchford presiding, in favor of the plaintiffs. If this decision is sustained by the United States Supreme Court, the Western Union Telegraph Company will be the possessors of one of the most gigantic of modern monopolies. The company will have the control of nearly all telegraph and electrical instruments, telephones perhaps excepted. In fact from the present time onward, until the Supreme Court gives a contrary decision, the Western Union Telegraph Company are masters of the field. By this decision, it may almost be said, that the exclusive right to use electricity for commercial and domestic purposes is taken from the public and transferred to the hands of the above corporation. This result is due to the wicked practice of private legislation in which Congress too often indulges. The injury done in this way to the public interests is incalculable.

The history of this case is briefly as follows:

Many years ago, dating back to 1836, it is said, Charles Grafton Page, of Washington, D. C., first made electrical inventions, among which, it is alleged, was an electrical coil and armature, which had a set screw applied to adjust or regulate the throw or motion of the armature. Without this little set screw, or its mechanical equivalent, it would be practically impossible to work an ordinary telegraph instrument, signal apparatus, burglar alarm, or electric motor.

Page suffered his invention to go into public use without taking steps to apply for a patent, and under the general patent laws, in consequence of his neglect, lost all right to a patent.

But in 1854 it appears to have occurred to him that perhaps at some future time or another he might coax Congress to grant a special act in his favor, and as preliminary thereto be filed an application for a patent, which under the law was refused examination, on the ground that the invention was public property, and he himself was an examiner in the Patent Office. Page was, in fact, the examiner of electrical patents, and for many years it had been his official duty to issue hundreds of patents, all of which contained his alleged original invention.

In 1868 Page was taken sick, and when it appeared that he had not long to live, Congress, at the instance of his friends, with a view to assist his family, passed the following unwise and sweeping act:

Chap. XXXII.—An act to authorize Charles Grafton Page to apply for and receive a patent:

Be it enacted by the Senate and House of Representatives of America, in Congress assembled, that the Commissioner of Patents is hereby authorized to receive and entertain a renewal of the application of Charles Grafton Page for letters patent for his "induction apparatus and circuit-breakers," now on file in the United States Patent Office, including therewith his circuit-breakers described by him prior to said application; and that if the Commissioner shall adjudge the said Page to have been the first inventor thereof, he *shall issue* to him a patent, *which patent shall be valid* notwithstanding said Page's invention may have been described or in use prior to said application, and notwithstanding the fact that said Page is now an examiner in the United States Patent Office: *provided*, that any person in possession of said apparatus prior to the date of said patent shall possess the right to use, and vend to others to use, the said specific apparatus in his possession, without liability to the inventor, patentee, or any other person interested in said invention or patent therefor.

Approved March 19, 1868.

On the passage of this act the Commissioner of Patents, in accordance with the mandates of the special law, caused the examination to be made, and then ordered the issue of a patent, which was dated April 14, 1868. Dr. Page died May 5, 1868.

It was pretty generally doubted at the time of the passage of the law and the grant of the patent, whether the latter could ever be sustained in the courts, and among the greatest doubters were members of the Western Union Telegraph Company. However, as there would be a possibility of litigation against them in any event, by the holders of the Page patent, they concluded that the safest way was to purchase an interest in the patent enough for their own protection, and for a small sum they acquired such interest from the heirs of Mr. Page. Subsequently, it appears, the Western Union Company acquired the substantial control of the patent, and in 1874, after careful preparation, brought this suit against the Holmes Burglar Alarm Company as a test suit.

Judge Blatchford's decision, we understand, sustains all the points made by the plaintiffs. It was urged in the case that the Special Act of Congress, in 1868, was unconstitutional, as the apparatus had been in use so long, but the decision is that the Special Act was constitutional. The validity of the entire patent was affirmed, the claims specifically sustained in the decision being the eleventh, twelfth, and thirteenth, and here is where the great importance of the case appears. These three claims are:

11. The adjustment of the retractile force of an automatic circuit breaker, as set forth.

12. The combination of an electro magnet armature and adjustable retractor.

13. Adjusting or regulating the length of vibration of the armature of an electro magnet by means of a set screw or any mechanical equivalent for substantially the same purpose, substantially as herein set forth.

We intend in a future number to discuss the subject further and present abstracts from the Judge's decision, which, we are informed, covers fifty pages, and is a very formidable and exhaustive document.

THE INSPECTION OF SMALL STEAMERS.

In his report for 1879, the Supervising Inspector General of Steam Vessels took notice of the excessive license fee for steam yachts and other small vessels using steam power, and suggested that a charge of $5 would be enough for the annual inspection of such craft.

The objection to the present fee of $25 is two fold; it is out of proportion to the size and importance of the vessels paying the license, being as much as is charged for steamers of 100 tons burden, and it is practically prohibitory to a large class of men who would otherwise build and use such vessels for pleasure or profit. There are thousands of miles of inland waters, small lakes, rivers, bayous, and the like, which would in the aggregate play an important part in furthering inland commerce, if small steamers could be used without having to pay an inspection tax large enough to swallow up all or a great portion of the profits of such use. Thousands of farmers, cotton growers, fruit growers, and others, might, and we are confident would, find such vessels an easy and profitable means for conveying produce to local centers of distribution and consumption, to the great advantage of local and general traffic, where ordinary cartage is impossible or unprofitable. This with the great extension which would be given to the employment of steam power for propelling pleasure boats by a reduction of the inspection fee could not fail to give a great impetus to the manufacture of small boilers and engines, and to their adaptation to many lines of domestic and productive work. Already the limited use of steam for small pleasure yachts has given rise to many inventions and the development of considerable industrial establishments. The very important torpedo boat of Herreshoff may be instanced as one of the indirect fruits of the manufacture of small marine engines, and there is no telling what other inventions of radical importance might not result from the lifting of the practical embargo which an excessive license fee has hitherto laid upon the general use of small steamers.

It is gratifying to note that a bill has been introduced in Congress to carry out the Inspector General's recommendation. Its passage would be altogether beneficial.

Another Comet.

The Smithsonian Institution has received from the Astronomer Royal of England the announcement of the discovery by Gill, at Cape Town, South Africa, on February 12, of a comet in 8 hours 58 minutes right ascension, 12° 31′ north declination, with a daily motion of 2° 35′ in right ascension and 20′ south.

ARTIFICIAL DIAMONDS.

A new dispatch from London states that Professor Maskelyne, of the mineral department of the British Museum, announces the production of artificial diamonds by J. Ballantine Hannay, of Glasgow. Tests by Prof. M. leave no doubt that the crystals are diamonds. In our SUPPLEMENT, No. 216, Feb. 21, we gave an account of the production of artificial diamonds by R. S. Baxter, of Dundee, whose specimens are also positively identified as diamonds. The MacTear crystals, it will be remembered, were proved not to be diamonds.

A NEW METEORITE.

Following closely upon the Estherville, Iowa, meteorite of May, 1879, comes the finding of another lost celestial body, this time in Alabama. In 1873 a heavy mass of metal was found by John F. Watson while plowing on a newly cleared piece of land near Chulafinne, Cleberne county, Ala. Among many early speculations as to its nature, some thought it to be bog iron ore, as there are deposits of this ore in the vicinity; others thought it might be native iron. Mr. Watson, to test (?) it, had a small piece cut off by the village blacksmith and forged into a plow point, and had also some horseshoe nails made. It being so easily wrought tended to confirm the native iron theory. It is well known among scientists that terrestrial iron is of extreme rarity, being found only in few basaltic rocks, and then in very inconsiderable quantities. During the seven years following the discovery its real nature was unsuspected and not recognized until revealed in the following manner:

Mr. W. E. Hidden, an expert mineralogist and attaché of Mr. Thomas A. Edison, while in this region last November prospecting for rare minerals, met with ex-Governor W. H. Smith, of Alabama, and heard from him the facts as above stated. This aroused his curiosity, as his knowledge of mineralogy convinced him that in view of the facts as stated, the several hypotheses were incorrect, and that the mass of metal was of meteoric origin and not an ore of iron.

After a considerable outlay of time and money it was finally brought to New York city, and is now in Mr. Hidden's cabinet, which contains three other undescribed meteorites from the Southern States, collected within a year, this one being the largest and of most interest.

Originally it was reddish brown in color and incrusted with scales of rust, which fell off while being heated in the forge. It now weighs 14·5 kg. (31 lb.), about 1·5 kilos having been cut off to make the plow point and horseshoe nails as stated. Its shape is somewhat triangular, the three diameters being each about 25 cm.; it has an average thickness of 6 cm.

A fine metallic surface was readily obtained by filing, which, polished and etched with nitric acid, developed with marked perfection the Widmannstätten lines, which is the convincing proof of its meteoric origin.

A careful analysis by J. B. Mackintosh, M.E., of Columbia College, shows it to be beyond a doubt a meteorite, and of the usual iron-nickel alloy variety.

The quick oxidation of meteorites in our atmosphere, and its being found at only a slight depth from the surface, would warrant placing the date of its fall not later than twenty-five years ago. This wanderer through space, which has strayed from its path and is now on an endless visit to us, will be placed for a short time on exhibition at Tiffany's, Union Square, New York city. This meteorite must not be confounded with the famous Claiborne, Ala., meteorite, which latter, it will be remembered, did not show the Widmannstätten figures, and contained besides an unusual percentage of nickel.

The particulars of this new meteorite are from an interesting paper lately read by Mr. Hidden before the Academy of Sciences in this city.

The American Society of Mechanical Engineers.

A new professional organization, the American Society of Mechanical Engineers, was born in this city February 17. Hitherto American mechanical engineers have had no national society; and this branch of the engineering profession has lacked in consequence the mutual aid and professional coherence which has characterized the departments of civil and mining engineering, whose powerful associations have proved so beneficial to the members of them.

Accordingly, by invitation of Professors Thurston, Sweet, and other prominent mechanical engineers, some thirty gentlemen of eminence in the profession, from most of the Middle and Eastern States, met as above stated to take the preliminary steps for organizing a national society. Letters were also read from a dozen or more prominent engineers encouraging the project. The meeting was called to order by Professor John E. Sweet, formerly of Cornell University, and Messrs. A. L. Holley and Samuel S. Weber were chosen chairman and secretary.

The object of the society, as set forth in the original draught of the by-laws and rules for the government of the association, is to enable mechanical engineers to meet and compare notes, and to facilitate the interchange of ideas respecting improvements in the various branches of mechanical science by the publication of papers, etc. The members are to be divided into four classes—regular members, associates, honorary members, and junior members. The initiation fees are fixed at $15 and $10, and the annual dues $10. Payment of $150 will entitle eligible candidates to life membership. Seven years' practice as mechanical engineer is a condition of membership, provision being made in junior membership for such as have served for a shorter period.

HYDRAULIC RIVETING.—TWEDDELL SYSTEM.

The increased use of wrought iron, and especially of riveted wrought iron work in construction, calls for convenient and efficient rivet driving machines. The system of hydraulic riveting machines, invented by Mr. Ralph H. Tweddell, of London, England, has been extensively introduced in England, on the continent of Europe, and to some extent in this country. Mr. Tweddell's machines are made either portable or stationary, and many ingenious arrangements have been contrived suited to various kinds of rivet driving. In the early power rivet driving machines the riveting die was moved back and forth a fixed distance by a crank, cam, or toggle joint movement, and the work done was not of necessity uniform, inasmuch as variation in size or length of rivet, thickness of the iron plates, or size of the holes to be filled, caused this, at all times equal, motion of the riveting die to

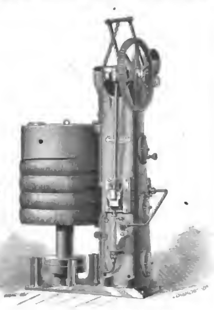


Fig. 1.—PUMP AND ACCUMULATOR.

compress either too much or too little, as the case might be. Direct acting steam riveting machines next came to be used, and with them equal work is done, even with very considerable variation in both rivets and holes, so long as the boiler pressure actuating the machine is kept uniform.

Direct acting steam riveters are not readily made portable, on account of the low pressure of steam and the consequent large size of the cylinder required. Thus, steam riveting machines for boilers are made with cylinders from 31 inches to 42 inches diameter, according to the work required. Steam used is generally 70 to 80 pounds pressure to the square inch. Hydraulic riveting machines with cylinders 6½ inches diameter, and with water under a pressure of 2,000 pounds to the square inch, will do the same work as a steam riveting machine with 36 inch cylinder, with 60 pounds of steam. The

Fig. 2.—SUSPENDED RIVETING MACHINE SIDE VIEW.

important feature of Mr. Tweddell's system of riveting machines, apart from the ingenious arrangement of the special machines, lies in the use of an accumulator, in which the water is stored under pressure, and from it admitted to the cylinder of the machine, where its power depends upon the load on the accumulator plunger; by adjusting the load on the accumulator to suit the size of rivet to be driven, the utmost uniformity is insured in the riveted work.

The outfit required for the Tweddell system of hydraulic riveting consists of a pump and accumulator and the machine proper; the latter may be either stationary or portable. We give (Fig. 1) a cut of the pump and accumulator. In this the pump is double acting, operated by crank motion. It takes its water from a reservoir in the upright, the return water, re-entering the reservoir, passes through a mass of sponge to filter it. The water on its passage from the pump to the accumulator goes through a relief valve on the back of the upright. This valve is so constructed and controlled by the motion of the accumulator as to relieve the pump from work without stopping its motion when the accumulator is full, and starts it to pumping into the accumulator as soon as the accumulator weight has descended a short distance. When the valve is open the water under pressure in the accumulator is shut off from the pump; the pump relieved from pressure draws water from the reservoir and forces it back into the same reservoir, maintaining the action without strain, but is ready to resume its work when required. When the relief valve is closed the pump forces water directly into the accumulator.

The accumulator holding enough water for, say, two strokes of the riveting machine, is soon filled by the pump; when full the pump must either be stopped or the water be discharged elsewhere. To stop the motion of the pump each time the accumulator fills involves its being started again as promptly when required. This is not readily done, and risks the loss of water and entrance of air into the pump chamber, while standing. To continue to run the pump and discharge under a safety valve, involves an expenditure of power when no work is being done. The arrangement employed maintains the motion of the pump ready for immediate action, and yet relieves it from strain when not required to do work.

The accumulator is arranged with weights suspended below the main casting, so made as to be readily released from it in order that the pressure may be adjusted to the work being done. Each weight represents a pressure of 250 pounds per square inch on the ram of the riveting machine. The maximum pressure obtainable when all weights are in place is 2,000 pounds per square inch, and it may at will be made 1,000, 1,250, 1,500, 1,750, or 2,000 pounds per square inch.

For bridge work construction in the shop the pump and accumulator are placed in any convenient position, and the water under pressure is carried from the accumulator through jointed or flexible pipes to the portable hydraulic riveting machine suspended from an overhead carriage.

The work, resting on trestles, remains stationary; the machine is moved along it from rivet to rivet to be driven. The riveting machine itself is adjustable within a hanging bail, and can thus be made to present itself properly to seams, horizontal, vertical, or oblique. In Figs. 2 and 3 we show the portable riveter in these positions. The dies are carried by levers, and the hydraulic cylinder acts upon levers of the third order, so proportioned that the die pressure is two-thirds of the cylinder pressure.

The overhead carriage, which is usually applied to these machines, has a motion of 50 feet in one direction and of 6 feet at right angles to the first motion, so that the riveter can act anywhere over a space of 50x6 feet of the shop floor. In this space the work rests on trestles, and the riveting machine is moved along or around it.

One man raises or lowers the riveter and moves it along the work. The rivet driver adjusts it to the work and closes the dies by a motion of the valve lever; on beam work as many as 10 to 16 rivets can be driven per minute. For boiler work the riveting machine is made stationary, as shown in Fig. 4, and the work is presented to it hanging from a suitably arranged crane.

Sometimes for deep girder work a portable machine, similar to the stationary one, is suspended upside down from a hydraulic crane, and made to move from rivet to rivet over the deep girder, all the motions being controlled by the operator.

Hand riveting is a trade of itself, on boiler work the same number of men form a gang to drive one rivet at a time as is required to run a hydraulic riveting machine and to operate the hoisting machine. With hand riveting the work stands still and the men move about it. With the stationary riveter the entire boiler or other construction must be taken to the machine and moved about it. The men required to work the hydraulic riveter are not trained riveters. In riveting boilers by power the necessity of holding the rivet until it is cool limits the operator to five rivets per minute, to do good work. If it were not for this reason ten rivets could easily be driven per minute; but even with this restriction it is claimed that the comparison between hand and power riveting in the same shop is ten to one in favor of power riveting in reference to the number of the rivets driven, taking into consideration all the time required to move the boilers to the machine, or lost in setting up the work. In girder work the difference is greater in favor of power rivet driving; as many as 5,000 rivets are said to have been driven by one gang with one portable hydraulic riveting machine in ten hours, including all the lost time of setting up the work and removing it when done.

Many experiments have been tried to determine the efficiency of direct acting power riveting machines in comparison with hand driving. The hand rivet fills up the hole very well immediately under the head formed by the hammer, but sufficient pressure could not be given to the metal, or rather it could not be transferred far enough to affect the metal some distance from the head.

So great is this difficulty that in hand riveting much shorter rivets must be used, because it is impossible to work effectively so large a mass of metal with hammers as with a ma-

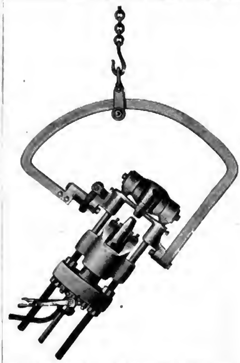


Fig. 3.—SUSPENDED RIVETING MACHINE—BOTTOM VIEW.

chine. The heads of the machine rivets are therefore larger and stronger, and will hold the plates together more firmly than the smaller hand riveted head.

The cuts we have presented of Mr. Tweddell's riveting plant are illustrative of the machines as made in this country by Messrs. Wm. Sellers & Co., of Philadelphia. This firm controls the invention in the United States, and has added many improvements to the original machines.

The Scientific American Catalogue.

We have ready for delivery a catalogue of many of the important papers published in our SUPPLEMENT for some time past. These papers are by eminent writers in all the various departments of science. News agents and others who desire copies of this catalogue can obtain the same free by addressing the publishers, Munn & Co., 37 Park Row, New York.

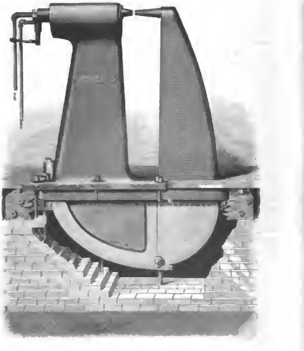


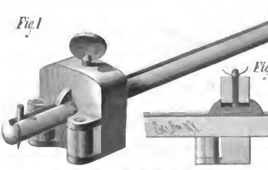
Fig. 4. STATIONARY RIVETING MACHINE.

IMPROVED CARPENTER'S GAUGE.

We give herewith an engraving of an improved carpenter's gauge designed for both measuring and marking. It is especially useful in following curved surfaces. Figure 1 is a perspective view, and Figure 2 is a longitudinal section taken through the center of the gauge shaft. The improvement consists in providing the gauge with two bearing rollers, one on each side of the shaft. These rollers are arranged in relation to the other parts, so that they furnish two bearing points equidistant from the gauge shaft and parallel with the face of the gauge head.

This form of gauge insures the same accuracy in gauging or measuring from curved edges as from straight edges.

Further information may be obtained by addressing the inventor, Mr. Alban Heiran, San Leandro, Alameda Co., Cal.



HEIRAN'S CARPENTER'S GAUGE.

Trichinosis.

The *Veterinarian* for February has a very comfortless article on trichinosis. It draws attention to the extremely small amount of knowledge we have of the extent of prevalence of trichinæ in home-fed pork, to the certainty of this form of parasite infesting largely American pork, and to the difficulty of discriminating trichinosis in man from enteric fever and acute rheumatism. From these considerations it argues that trichinosis is probably of more common occurrence among human beings in this country than has hitherto been conceived, and suggests the necessity of some steps being taken by the Government or the Legislature to insure some greater degree of safety in this matter than now exists. Our contemporary confesses that it is much easier to advise than to act, but inertness under such circumstances is unjustifiable.

NEW FLUID PROPELLER OR MOTOR.

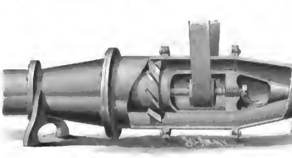
The annexed engraving represents a device for propelling fluids through tubes, and also for utilizing the motive force of fluids flowing through tubes.

A wheel having diagonal blades is mounted upon a shaft journaled axially in a cylindrical casing. This shaft is supported by a hollow cylinder which covers the sides of the wheel, leaving only the blades exposed.

The inner cylinder has conical ends, and is connected with the outer cylinder by hollow arms through which passes a belt, which drives the wheel when the device is used as a fluid propeller. When the machine is used as a motor the belt receives its power from the pulley on the wheel shaft. The inventor proposes in addition to the uses already named to use the device as a fluid meter.

In actual use the main casing will be connected with the pipes through which the fluid is to be moved or through which water flows if it is to be used as a motor.

This improvement is the invention of Mr. John B. Vliet, of Dartford, Wis.



FLUID PROPELLER OR MOTOR

NEW LAWN EDGE MOWER.

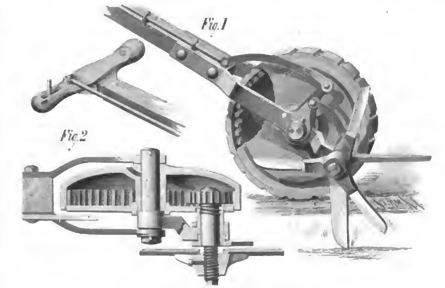
The annexed engraving represents a simple and effective machine for mowing the edges of lawns, borders, etc., a work that is generally done by hand tools with considerable labor if indeed it is done at all.

By reference to the engraving it will be seen that a three-bladed cutter, driven by a single drive wheel, is arranged to revolve in front of a nearly vertical stationary cutter. Both the stationary and rotary cutters are supported by an arm extending forward from the main axle of the machine. The height of the cutting mechanism is adjusted by moving the main axle in one direction or the other by means of a lever at the end of the mower handle, acting through the connecting rods extending down the handle, and jointed to and extending upward from the main axle. The stationary cutter and a horizontal finger or guard are secured to a sleeve on the shaft which carries the three bladed cutter, and they are kept at the proper angle by a link connecting an arm on the knife-supporting sleeve with an arm on the lower end of the handle.

Fig. 1 shows the mower in perspective; Fig. 2 is a section taken through the axes of the drive wheel and the rotary cutter; and Fig. 3 shows the lever at the upper end of the mower handle.

This mower is provided with ratchets to admit of drawing it backward without revolving the knives, and it has all necessary adjustments to compensate for wear.

Further information concerning this useful invention may be obtained from the inventor and patentee, Mr Timothy Hanley, 1679 Tremont street, Boston Highlands, Mass.



HANLEY'S LAWN EDGE MOWER.

Engines for Farmers.

A writer in the *Prairie Farmer*, who seems to be familiar with the various engines in use for agricultural purposes, thinks that great improvements may be made to render farm engines more available. Of the locomotive self-propelling kind he ranks the Aveling & Porter machines as unequaled in point of efficiency, durability, and economy. The only objectionable feature of these engines, and not only these, but of all that have yet been produced, is the great weight. Inventors and manufacturers will do well to remember that an agricultural and farm locomotive, to prove satisfactory, must have the following qualifications.

1. It must be sold at a moderate price.
2. It must be well made, strong, and durable.
3. It must be so designed that one man can operate it.
4. It must carry its own fuel and water, in quantities sufficient for several hours' work.
5. The weight should not exceed 9,000 pounds.
6. It must have wide wheel-bearing surface.
7. At least 75 per cent of the entire weight should be thrown on the drive wheels so that they will not slip.
8. It must be easily and quickly started, stopped, reversed, or turned around.
9. With an ordinary load, it should travel at a speed of from four to six miles per hour.

An engine having all the above qualifications would prove to be well adapted to the needs of the farmer, and there is probably no better field than this for the inventor and manufacturer to exert their ingenuity.

The Weather and Health in Europe.

It would seem that Ireland is not the only place abroad whose people are in a distressed condition. Intense cold has prevailed over all Europe this winter, beginning early and lasting with continued severity. The effect on the public health has been trying. The mortality reports of all the large cities, according to the *Medical Record*, show an increase in the annual death rate quite striking at times. Rome has reached 38 and 40 per thousand per year. In Naples a malignant fever has been prevalent. At the health resorts on and near the Riviera cold rains, light snows, and damp days have prevailed. At Berne, one hospital received in the week before Christmas 50 patients suffering from severe frost bite. In Paris the applications for entrance to the hospitals in December were 1,000 a week in excess of the accommodations. Silesia has been frightfully ravaged by hunger and typhus, as has also Ireland at one extremity of the continent and Turkey at the other.

Very recently a Rome dispatch to the London *Standard* says: The accounts from Terra di Lavori, Naples, continue to be terrible. The population of seventeen communes especially afflicted numbers 92,882 persons. Of this number, 51,340 had been attacked by fever up to the 15th of December last. This fever means famine. The government aid is not sufficient.

Scientific Farming Practical.

Mr. Buckmaster, before a well attended meeting of farmers, held at Tadley, in England, the other day, to consider a scheme for teaching the science of farming, said that there was no opinion more deeply ingrained in the mind of the English farmer than the belief that there was some antagonism between science and practice. Some even went so far as to say that the two are incompatible. The farmer who drains his land or tries a new manure, or a new machine, or a new crop, calls himself a practical man; he despises all experiment, and laughs at the teaching of scientific men. He is not conscious that when he is thinking over new plans and adopting new methods of cultivation he may be illustrating in his daily work a series of chemical and physiological experiments of extreme complexity and importance. Men of the highest order of intellect, and whose researches were the most original, have been practical men. Practice and theory are but phases of the same form of thought. The practical farmer, if he ever permits his mind to rise above the traditions and empirical rules of his forefathers, and asks, "Could not that have been done in a better and more perfect way; would not this be an improvement?" becomes a theorist, and when he tries to realize these conceptions becomes a practical man. Theory and practice are inseparable in every art, however much men may seek to disunite them. The most practical man is often the most theoretical. Every operation is with him a theory. He recognizes no change; he will admit of no trial or experiment, because that would be an acknowledgment of science. Every science is built up of principles, and these principles carried into work are called practice. There is the science of astronomy and the art of navigation; the science of geometry and the art of land measuring; the science of mechanics and the art of making machinery; the science of chemistry and the art of agriculture. Almost every science is the basis of a cognate art. The most obvious and natural way of arriving at a real knowledge of the art of agriculture would be to know something of those principles on which the art is based, art being nothing more than the application of principles previously acquired. A farmer who is able to unite a perfect mastery of principles with a knowledge of practical details is an educated and scientific farmer. It might reasonably be inferred that the shortest and easiest method of learning any industrial art, and the surest guide to new discoveries in the art, would be a knowledge of those fundamental principles upon which the art was based. No amount of practical skill and experience could ever replace the want of scientific knowledge in farming.

Correspondence.

Vaccination and Science.

To the Editor of the Scientific American:

Your issue of November 15, 1879, lies before me, containing a strange article entitled "Anti-Vaccination Folly." I am somewhat amused to find how many concessions you make to those whom you charge with "folly." For instance, you say "the adverse statistics derived from European experience, or from American experience, previous to the adoption by our physicians of correct methods and uncontaminated virus, may be all strictly true, and doubtless are substantially true; yet our confidence in proper vaccination need not be shaken in the least."

Permit me to point out that those who have so much "experience," and so much "statistics" in their favor, cannot be, by any scientific rules, "fools." The scientific method proceeds by experience, and the collected results of experience (statistics). It appeals to facts, and to facts above suspicion—"true" facts. It deduces nothing from conjecture, where conjecture is not only out of place, but contradicted by facts. And yet you concede our European facts, permit us certain admissions from American facts, and then denounce us as having sent you a gentleman "with a craze," to "propagate our notions"—our "anti-vaccination nonsense"—in America.

Hard words are harmless, except as they lead to violent behavior. And your position as promoters of science may give to your hard words force which may spend itself in violent behavior toward worthy American citizens. It is, therefore, my duty and my pleasure to show that our cause is the cause of science and of freedom.

Now, to begin with, what is your charge against us? It is, that however true our arguments may be in England, or Europe even, they "can have no application here," *i. e.*, in America. And we are urged to "study the methods employed in this country, and try them at home."

Now, will it be believed that this is actually the whole case urged against us? Bovine virus, or not "over-humanized" virus, will stamp out—I understand you to say has stamped out—smallpox in New York. Therefore it will anywhere. But I have made myself as familiar as Dr. Martin's very courteous behavior toward me has enabled me to become, with your American system.

That system, let me tell your readers, is nothing new. It has been in operation in Europe from Dr. Jenner's day to this. And it has here yielded no such results as you describe it to have accomplished in America. Smallpox, let us all be cool-headed enough to remember, is an epidemic disorder. For long years it is absent, and then comes like a flood. It was declared in 1870 that the excellent vaccination in Ireland had banished the smallpox. In 1878 they knew at fearful cost the error of any such a calculation. I am not aware of any existing real positive evidence showing proof that bovine virus is better as a protection than "arm to arm." Dr. Warlomont has had great experience of the very same system as the one you advocate. He has a few days since appeared in London to give *éclat* to an endeavor to procure state patronage for "calf lymph." What does he say? Our system, he said, was "to be scrupulously observed. . . . This proposition is based upon a fact, without which it could not be maintained—the perfect identity between the lymph of the child and of the calf, so far as regards their active principle." He cites experiments made to prove this, and continues: "The identity is, therefore, perfect as to the nature of the active principle of the lymph, whether it is derived from the calf or the child." . . . "This identity is established, if possible, still more completely by my own personal experience."

"But it will be asked," he says, "if the two lymphs are of equal value, why call to the aid of humanized lymph, the supply of which never fails, the assistance of animal lymph? The answer is that this help is especially necessary to satisfy doubts, fears, imputations, and perhaps prejudices."

I hope these quotations make it clear that arm to arm lymph is equal in power and energy to calf, in the opinion and by the experiments of one of the most ardent defenders of bovine virus. Things which are equal cannot differ in quality.

But why, if it is so much more powerful, do the calf specialists, when pressed, deny its superior powers against smallpox? Why is there no array of European experience to prove its virtues, for it has been propagated here long, long years before it was thought of by Dr. Martin? The answer is that given by Dr. Warlomont: It is not used because it is more prophylactic, but to satisfy doubts, fears, and prejudices.

Now, may I assume my contention as to the absence of proof of the superior virtue of bovine virus proved? Evidence showing it does not exist, its own defenders abandon the contention when pressed.

But by the very crucial evidence to which you refer, we know scientifically the want of value in the arm-to-arm or "classic" method. Here is the last nine years of smallpox hospital experience I am able to get access to: Liverpool Hospital, 1875–6; Glasgow, 1870–2; Homerton, 1871–6; Metropolitan, 1870–1–2; Dublin, 1870–3, 1876 and '8; London 1876 to 1879 to Oct. 1—these yield 37,636 cases of smallpox. And the medical gentlemen attending these cases record no fewer than 28,468 of them as vaccinated. There is here an unparalleled failure, a signal disproof of Jenner's rite. Hold! you say, how many died?

Now the answer to that question set the *Lancet* thinking a very long time since; and I am not aware that up to this time it has thought out a satisfactory explanation. Our answer is that the number recovered out of every hundred of these hospital cases is roundly just what it was before Edward Jenner was born, namely, 82.

Jurin, 1723, gives nearly 83; Duvillard, 1700 to 1763, gave nearly 82; Rees, 1779, just 82.

And, further, the character of the disorder remains exactly the same that it was and has been so far back as exact accounts show it. The fatality now as ever is just as is the eruption. If that is extensive, then the deaths are numerous; if malignant, nearly all die; if the pustules are few and far between, the mortality is very slight indeed. This is the scientific classification of the disease. It is unaffected by vaccination, and applies to unvaccinated and to vaccinated alike. So it was before Jenner's day, so it is now.

But a disorder which treats its victims just as it treated them before the "annihilator" of it appeared, which follows the same erratic ways of appearing, which cannot be controlled in this epidemic tendency by its "annihilator," is, let us be plain and straightforward enough to confess, an untouched disorder. The so-called preventive is therefore a delusion. The money spent upon it is therefore wasted; liberty invaded and the person violated in its favor are therefore wantonly and unjustifiably treated to the national ill-being. Superstition usurps the place of reason, and violence the place of right.

It must follow from these considerations, which every fresh experience does but confirm, that the day will come when the men of science will denounce this rite. Then the gentlemen who, in the cause of science and humanity, visited you some time since to show the nature of this delusion, and endeavor to clear America from so great a stain upon free institutions, will receive his due. Galileo, condemned by the men of his time for having a craze; Bruno, burned by the great men of his day for being a pernicious fool—are the honored of Italy to-day. So will all those be who, against much prejudice and opposition, strive to lead the people to the light, supported by science, and encouraged by the fact that truth is on their side.

I am yours truly,

Darlington, Eng. ALEX. WHEELER.

Solar Spots.

To the Editor of the Scientific American:

During the past few days excellent and interesting observations of sun spots have been made. This phenomenon of our central orb has been quite infrequent for two or three years, having been passing through the minimum stage of the spot periodicity. The cycle or period is about eleven years, and for the coming five or six years large numbers may confidently be expected, and of very extended dimensions.

On the morning of the 3d inst., two separate groups of spots were noticed, situated one above the other, and having made about one-third of their transit of the sun's disk, as represented in Fig. 1. All the figures are shown as seen in the telescope, or inverted.

The group marked A was a fine double one, preceded by an intensely black, small, round spot, as shown in the sketch

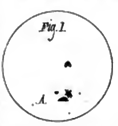


Fig. 1.

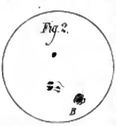


Fig. 2.

near A. On the morning of the 6th, this small round spot had disappeared, but others had developed upon the other side of the double one; and just fairly entered upon the eastern limb was a fine large spot (B, Fig. 2), which promised to develop into an interesting group. The appearance of the sun on this occasion is shown in Fig. 2.

On the morning of the 8th the sun's face presented the appearance shown in Fig. 3. The spot, B, confirmed the impression given on the 6th, and by its improved position, as well as some internal change, gave us the appearance here shown in Fig. 3. My attention was also attracted to some new very minute spots near the center of the sun, marked C, Fig. 3. This was the appearance on the morning of the 8th. In the afternoon of the same day, or only five hours later, these minute spots had changed into the appearance shown in Fig. 4, drawn to the same scale—a wonderful change having thus taken place in these few hours. What an enormous energy is here manifested!

Fig. 3.

Fig. 4.

The group, B, continues to be one of the greatest interest. It is large, and broken up into a number of parts, surrounded with a delicate penumbra and straggling lines. Fig. 5 shows a highly magnified view


Fig. 5.

of this group as seen this morning, February 9, 1880.

WILLIAM R. BROOKS

Red House Observatory, Phelps, N. Y., Feb. 9, 1880.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR MARCH, 1880.

Mercury.

On March 1 Mercury rises at 7h. 10m. A.M., and sets at 6h. 56m. P.M. It may be found 2° east of Jupiter.

On March 31 Mercury rises at 5h. 25m. A.M., and sets at 5h. 29m. P.M.

Mercury is at its greatest elongation from the sun on March 10. It should be looked for after sunset, in the first half of the month, a few degrees north of the point of sunset. In the latter part of the month it sets too nearly with the sun to be seen.

Venus.

Venus is still seen in the morning, although nearer the sun and less brilliant.

On March 1 Venus rises at 5h. 9m. A.M., and sets at 2h. 50m. P.M.

On March 31 Venus rises at 4h. 52m. A.M., and sets at 3h. 59m. P.M.

Venus is near the waning moon in the morning on March 8.

Mars.

On March 1 Mars rises at 10h. 12m. A.M., and sets at 1h. 14m. of the next morning.

It can be seen north of Aldebaran on the 3d.

On March 31 Mars rises at 9h. 16m. A.M., and sets 33m. after midnight.

The "American Nautical Almanac" gives the time of an occultation of Mars by the moon, on March 17, as 6h. 22m. P.M., Washington time.

The moon will be at this time nearly at the first quarter, and Mars will be about an hour past the meridian, at a good altitude above the horizon.

The dark part of the moon passes first between us and the planet, and the planet disappears. Mars will be hidden for more than an hour, and will then reappear on the west of the moon; the strong red light of Mars and the pale yellow-white light of the moon will be shown in beautiful contrast. If the evening should be fine this will be very interesting, even as seen with the naked eye.

Jupiter.

On March 1 Jupiter rises at 7h. 8m. A.M., and sets at 6h. 39m. P.M. It may possibly be seen after sunset.

On March 31 Jupiter rises at 5h. 26m. A.M., before sun rise, and sets at 5h. 18m. P.M., before sunset. It may possibly be seen before sunrise.

Saturn.

On March 1 Saturn rises at 8h. 3m. A.M., and sets at 8h. 28m. P.M.

On March 31 Saturn rises at 6h. 14m. A.M., and sets at 6h. 49m. P.M.

In the early part of the month Saturn may be seen a little north of west when it sets; in the latter part of the month its diurnal path is nearly that of the sun, and it will not be seen.

Uranus.

Uranus is in good position for observers, almost at its best position, early in March, as it then comes to meridian a little before midnight, at an elevation of nearly 60° in this latitude.

On March 31 Uranus comes to meridian near 10 P.M.

On March 8 Uranus has the altitude of the star Rho Leonis; is east of it 2°, and moving toward the star.

Sun Spots.

The spots which were seen upon the sun in January returned in February, and were followed in their course from February 2 to February 6, photographs being carefully taken and drawings made. Up to February 6 three groups were seen, each of them including several spots.

After February 6 clouds interposed until February 8, when it was found that a fourth group had appeared upon the sun's disk; it had apparently formed among the others, but was not near enough to them to be a detachment from any one of them. Seen with a small telescope, some twenty individual spots could be counted in the four groups.

If these return again they should be seen late in February, and should by March 1 be easily found with a small glass, possibly with a smoked glass without magnifying power.

The Ali Baba Vase.

It is said that Miss M. Louise McLoughlin, of Cincinnati, to whom the ceramic art in America owes so much, has completed the largest vase ever moulded in this country. It is called the Ali Baba Vase, and stands 37 inches high, with a diameter of 17 inches. Before firing it measured 44 inches in height and 19 inches in diameter.

AMERICAN INDUSTRIES, No. 38.

MANUFACTURE OF ROLLED IRON.

The great revival of trade in the United States within the last few months has been marked by an unprecedented activity in iron and steel manufactures. This great activity is remarkable for the suddenness of its development as well as its universality.

There are at present more furnaces in blast in this country than ever before, and the rolling mills, although working up to their full capacity, are inadequate to supply the immense demand for manufactured iron. Now, as there is scarcely a mechanical occupation that does not depend for its tools, machinery, or raw material upon iron and steel, it follows that the condition of the iron industry is in some measure at least indicative of the state of other interests. It is not, therefore, to be regretted that the demand for iron is far in advance of the means of supply, as this state of things may be regarded as one of the best indicators of present and future prosperity.

For our principal illustration we have chosen from the many works devoted to the industry under consideration the Union Iron Mills, of Pittsburg, Pa., owned and operated by Messrs. Carnegie Brothers & Company.

These mills were established in 1860. They are devoted to the manufacture of structural iron for bridge building and architectural purposes, iron beams, channels, tees, angles, etc. Iron in these forms enters more and more into the composition of various structures, and this already extensive branch of manufacture must of necessity increase with the growth and development of the country.

The Union Iron Mills give employment to about 750 men, and are capable of turning out annually 40,000 tons of manufactured iron. The works cover eight acres of ground, with buildings as follows: Main building, 400 feet long and 80 feet wide, having attached to it five wings, each 137 feet long and 50 feet wide. The fitting shop is 100 feet long and 40 feet wide. The roll house is 150 feet long and 20 feet wide. The building covering the heating furnaces is 400 feet long and 37 feet wide. Two buildings in the puddling department are each 200 feet long by 65 feet in width. Two gas producer houses, one 100 by 50 feet, and the other 46 by 35 feet, cover twenty-four producers.

These extensive buildings contain the most approved modern appliances and machinery. The works are provided with thirty-one puddling furnaces, seven double Siemens heating furnaces, two single Siemens, and two reverberatory furnaces. The machinery is driven by seventeen engines located at different points, and arranged conveniently with reference to the work to be done. These engines are supplied with steam from fifteen boilers, twelve flue boilers, one Kilgore boiler, and two tubular boilers. The pump that supplies water for the purposes of the mill has a 16 inch cylinder and 8 feet stroke, and throws 700 gallons of water per minute.

The smaller view in the upper portion of the engraving, gives a good idea of the external appearance of the works, and some of the machinery is represented in the other views.

The first operation in the manufacture of wrought iron is that of puddling, which is simply a process of removing from pig iron, by the combined action of an oxidizing atmosphere and mechanical agitation, the carbon, silicon, sulphur, and phosphorus.

This operation is carried on in reverberatory furnaces, and attended by men whose business it is to stir the semi-fused pig iron on the hearth of the furnace until it is brought to the proper state of consistence, when it is gathered into balls as large as can be conveniently handled, and taken directly to the squeezer, which compresses the ball and forces out the greater portion of the scoria and cinder.

The squeezer is a powerful machine, consisting of a heavy corrugated cylinder revolving eccentrically in a concave frame. From the squeezer the bloom is taken while still hot to the rolls, through which it is passed several times, reducing it to the form of a bar called a puddled bar.

The puddled bars are piled together, reheated in the heating furnaces, and then passed through rolls, which shape them for market. There are six trains of rolls in the Union Iron Mills—one 20 inch train, two 18 inch trains, one universal plate mill, one 12 inch and one 8 inch train. The huge 20 inch train is represented in the larger view in the engraving.

These immense rolls, with their massive housings, seem the very embodiment of strength, and as they are revolved with a resistless power, it is a grand sight to see the heavy white-hot beams shoot out first from one side of the rolls and then from the other. The method of handling these large masses of hot iron is both simple and efficient. The mass of iron as it comes from the heating furnaces is delivered to the first pair of rolls by ponderous tongs, as it passes through it is caught upon the ends of levers whose fulcra are suspended from movable carriages above. The men holding the long ends of the levers, dexterously thrust the shorter end under the rapidly moving bar, immediately press down upon the longer end so as to give the bar support, and then follow the bar as it moves forward. After it has passed completely through the rolls in one direction, it is raised by the levers and guided between the middle and upper roll, and as it again issues from the rolls it is caught and supported by the men on the other side. The perfect ease with which these beams, weighing thousands of pounds, are handled is astonishing.

Some of the beams are cut into lengths while hot, others are cut while cold. This firm use three saws for cutting iron when cold, and four hot saws. They were the first to use "cold saws" for cutting iron cold. The machinery for sawing the iron is seen at the further end of the train of rolls. It is very like a cross cut sawing machine for wood, excepting that it is adapted to the heavy work of sawing the iron beams instead of wood. The beam to be sawed is placed upon a strong iron carriage capable of moving back and forth on a track, and is moved against the edge of the saw, which cuts its way through.

The gigantic machine shown in the small circular view is the universal plate mill for rolling the heavy plates used in building war vessels, turrets, etc. It is capable of rolling a plate 36 inches wide 3 inches thick, and almost any length. The plate as it passes from the rolls on one side or the other is supported by a series of large iron rollers. Among other pieces of heavy machinery employed in this establishment are two punches, one machine for slotting, and eleven heavy shears, all of which are massive, powerful, and well calculated to withstand the strain that must naturally come upon them.

In addition to the works above described, this firm own the Lucy Furnace for the manufacture of pig iron, employing 200 men and producing nearly 700 tons weekly. This furnace has two stacks, each 20 feet bosh and 75 feet high. The blast of each furnace is heated in four iron pipe stoves to a temperature of about 950 degrees. The blast is furnished to each furnace by two vertical direct acting engines, each having a steam cylinder 35 inches in diameter, a blast cylinder of 84 inches diameter, stroke 48 inches.

The supplies of ore used at this furnace are mainly from the Lake Superior region. The fuel consists of coke, about two thirds of which comes from the works of the firm at Carmenter's Station on the line of the Pennsylvania Railroad, the remainder coming from the Connelsville district.

An Owl at Sea.

The White Star steamship Celtic, which arrived at New York from Liverpool on Wednesday, Feb. 11, brought a strange passenger who had boarded that vessel in mid-ocean. A large white owl dropped on one of the forward spars in an exhausted condition one evening, when the vessel was about 800 miles off the coast of Newfoundland. When brought to the deck by a sailor, the owl was found to be nearly dead from cold and hunger, and almost too weak to eat.

It had become greatly emaciated, and trembled violently in endeavoring to swallow the first morsel of meat which was placed in its beak. The owl slowly recovered, and is now perfectly well. It is a land bird, and is supposed to have been blown off the coast of Newfoundland by the westerly gales which had for some days previous prevailed there. Finding itself once out at sea, it had probably ceased making efforts to reach the land, and had drifted before the gale, its only efforts being to keep above water. The bird must have possessed remarkable powers of endurance, the officers say, to have kept up so long. The Celtic's owl, which is now quite tame, measures nearly five feet from wing to wing, and is white with the exception of a few small specks of dark color. It will probably live for some time to come on board the vessel which it selected as its home while in mid-ocean. Land birds have rarely been seen so far out at sea.

Etching on Glass.

An article from the pen of William Gruene, of Berlin, on the process of etching drawings or letters on glass, in relief or opaque, has lately appeared in the Dresden *Glashütte*, which, says the *American Pottery Reporter*, we have translated and present to our friends, the glassmakers of America. As is well known, indestructible drawings on glass are made by a cold chemical process, by etching with diluted fluoric acid, first covering the places not to be eaten away with an acid-resisting material. The fluoric acid dissolves the glass without affecting the appearance of the parts protected. In consequence the drawing or design appears slightly opaque. The desired effect is then obtained by mechanical means. The elevated parts are ground rough, so that the alternate rough and smooth portions form the picture. The drawings must be etched deep, in order to avoid the deep lines in the mechanical work. It is necessary that all parts which are to become opaque must be covered with the coating, in order to avoid their destruction by the fluoric acid.

The new process described by Herr Gruene avoids all the difficulties surrounding the present process of etching, and enables the workman to stamp, mark, and ornament glass as if it were paper. The principle applied is as follows: The quality of the fluoric acid used is the same as in the old process, but the drawing is no longer made with a substance absolutely proof against the acid, but with another, protecting the glass only to a certain point of time, thus showing in the drawing the elevated marked opaque appearance. For such a covering almost all the lacs, oil varnishes, greasy printing dyes, etc., except the solutions of asphaltum, gutta percha, and caoutchouc, can be used. If applied thin, they yield to the concentrated fluoric acid, even after a few seconds, no matter how firmly dried they may have become. If the substances for covering are used simply for the above named purposes, they yield only a very feebly marked design, partly marked and partly blank; but if dusted after application with a finely pulverized powder of metal, copal, or any other substance capable of rendering longer resistance to the fluoric acid, the opaque drawing is obtained directly. This is the essential point of the invention.

For practical use the following advantages become apparent: 1. As the etching is rapid and not deep, no special protection of the surface by coating with acid-resisting material is necessary. 2. As only slightly resisting covering substances are necessary, the workman can use not only brushes, gravers, pens, and patterns for drawing purposes, but can also easily make transfers from all typographical, lithographical, copper, zinc, glass, and other prints. In like manner elastic stamps and forms can readily be used. As one can use, *ad libitum*, thicker or thinner coats, as well as apply coarser or finer powders for dusting, the opaque parts can be produced in any grain desired. In one and the same etching graded designs with proportional shades can also be produced.

The practical execution of this style of etching is carried out as follows: The article to be decorated receives the drawing by hand, stamp, or, as the case may be, by transfer. For the material choose an oily lac mixed with a little paint, so as to show on the glass. This done, dust in the powder. When dry, dip the part with the drawing into the fluoric acid, or put the latter on with a brush, and allow to remain a few seconds, or until the powder begins to come off. Then rinse with water. The greasy substance need not be removed, as the fluoric acid absorbs it.

The United States as a Wheat Country.

A little over thirty years ago the *Springfield Republican* notes that grain was imported to this country from the Black Sea. During the crop year on which the country is just entering, it claims that it is certain that 160,000,000 bushels of wheat will be exported to Europe, and the amount may reach 200,000,000 bushels. The grain is in this country; the only question is one of demand. The demand last year from Europe was for 150,000,000 bushels out of a crop estimated at 420,000,000 bushels. The production this year is larger. It is one-fourth larger in Kansas; in Minnesota the production this year is 40,000,000 bushels, a large advance over last year; the grain fields of Southern Ohio show an unprecedented yield; so do those of Iowa; and in Indiana the crop will, in some cases, pay for the ground on which it stands. The wheat acreage of the country is put at 31,000,000 acres, an increase of one-fifth in two years. The average yield is placed at 12 bushels an acre, and the acreage at 31,000,000 acres, by Alexander Delmar, who wrote to the *Times* in the close of July, after a trip through the wheat fields of the West, ending at Ogden. The statistician of the New York Produce Exchange puts the average yield at from 11 to 13 bushels; other more sanguine estimates carry it up to 13 or 14 bushels an acre. The lowest estimate yet made places the crop at 360,000,000, the largest at 440,000,000, and a crop of 420,000,000 may be reasonably counted upon. This is an increase in ten years of 183,000,000 bushels in the annual wheat production of this country, and an increase nearly equal to the total wheat harvest of twenty years ago.

Out of this year's harvest, reckoning the population in this country at 48,500,000 persons, 194,000,000 bushels will be needed for consumption and 50,000,000 for seed, in all 244,000,000; leaving, at the highest estimate, 196,000,000 for export, to which may be added 20,000,000 bushels left over from last year's crop. Whether the European demand will be equal the amount of surplus wheat in this country is considered by the *Republican* as doubtful. It will unquestionably equal last year's demand, and the value of the breadstuffs exported during the coming year will probably reach $150,000,000, and may rise to a higher figure. The unknown quantity in the wheat supply of the world is Russia. Its harvest has been pronounced far under the average for weeks past, but recent advices tell a different story. At best, however, nothing more than an average surplus for export is to be expected, not over 50,000,000 bushels; and if this is supplemented by the usual European import, 20,000,000 bushels from Roumania, and 5,000,000 from Canada and Australia, the total wheat supply which Europe is likely to receive from points outside of this country may be placed at 75,000,000. The current deficiency in Europe is placed at from 225,000,000 to 275,000,000 bushels.

The demand in England is clearly known. It will amount to about 110,000,000 bushels. The demand in France can be less accurately estimated. All Northern Africa is in a state of famine, or is producing barely enough for its own supply, leaving nothing for export. This cuts off one French source of supply in Algeria. The crops in Northern Italy have failed, and Italy is importing grain already, instead of exporting it, which closes another region from which France obtains grain. The potato crop in Northern France has generally failed, and the local food supply all over the republic is deficient. It is a low estimate, then, which places the French demand for wheat at 100,000,000 bushels. The rest of Europe will probably need 75,000,000 more, but may need less.

The food supply of a continent is not a thing to be easily reduced to figures. Moderate estimates, however, place the demand at a larger figure than the amount of the probable surplus in this country. It will probably all be needed, but our authority is not likely that it will be called for at high prices. This is the present outlook. Very trifling causes may change the existing condition of affairs in favor of high prices. One thing is certain: no crop of wheat ever harvested in this country will be carried to market more cheaply, and none, therefore, will leave a larger margin of profit in the hands of the farmers.

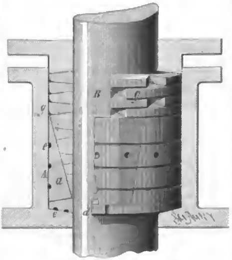
IMPROVED STEAM PACKING.

The sectional packing shown in the annexed engraving is designed for the stuffing boxes of steam cylinders, pumps, air chambers, etc. The metallic packing rings, *g*, have their adjoining faces inclined in opposite directions, so that the pressure of the gland will contract and expand alternate rings, and thus pack the stuffing box and the piston rod. These packing rings are used in connection with a conical sleeve, A, contained by the box and surrounding the piston rod. This sleeve is divided longitudinally into two equal parts, *a*, and into two small wedge-shaped pieces which lie between the ends of the larger portions. The ring is separated into sections in this manner to facilitate the removal of the ring from the stuffing box. Two semicircular pieces, *d*, are placed at the bottom of the stuffing box to adapt the ring, A, to the box. Grooves, *e*, are made in the ring, A *d*, to receive some of the water of condensation, which prevents overheating the packing.

Part of the rings, *g*, are beveled to adapt them to the inner surface of the ring, A. It will be noticed that when the gland is tightened up, the rings, *g*, when pressed, move alternately in opposite directions; that is, the first ring presses the piston rod, the second one presses the inner surface of the stuffing box, and so on.

The inventor claims that the packing remains tight, wears smoothly and evenly, and does away with a great deal of friction which is unavoidable in other methods of packing, and he furnishes a list of prominent mining companies and mill owners in the mining regions of the Southwest, who indorse it and are using it with entire satisfaction.

Further particulars may be obtained from the inventor, Mr. George C. Phillips, of Silver City, Nevada.



PHILLIPS' STEAM PACKING.

PROA LADRONIA.

This boat was built on Cayuga Lake, N. Y., 1877, for T. M. Prentiss, Boston, Mass. (Named for the Ladrone Islands, where the "Flying Proa" originated.)

CONSTRUCTION.—HULLS.

Two half sections of a boat—closed.

Inner Sides.—Smooth and straight from end to end.

Upper Sides.—Flat and at right angles with inner sides.

Outer Sides.—Modeled with as much attention given to lines as for a single boat, gaining thereby greater bulk and buoyancy than is possible in straight-sided round tubes or simply boat-shaped pontoons; immense reserve of floating power being essential in a double boat to prevent the leeward hull from being submerged in rough weather.

Ribs of hulls are of oak, covered with ¾ inch pine. Length of hulls over all, 17 feet; width, upper sides, amidships, 18 inches; depth, inner or flat sides, amidships, 20 inches; depth at bow, 29 inches; depth at stern, 24 inches. The hulls are placed 5 feet apart, and connected together by six transverse beams, each 3 inches square, firmly bolted and riveted, alike to the inner and outer sides of hulls.

Each hull is provided with a 2½ inch brass deck-screw for the purpose of pumping out. As yet there has been no occasion to use a pump.

DECK.

The deck or platform—laid in alternate strips of butternut and pine, ¾ inch thick and matched—is semicircular in shape at the bow and stern. Extreme length of deck, 15 feet; extreme width of deck, 8½ feet. The under surface of deck is sheathed and painted, to prevent any resistance of the cross beams to the passage of water between the two hulls.

Railing of oak—2 feet high—round the deck, having a base board 4 inches wide, and top board 2 inches wide. Intervening space—18 inches—of rope netting, painted red and white.

BULWARKS.

Painted oilcloth, wound round two spring window shade rollers placed perpendicularly inside a close fitting black walnut case, serves for bulwarks to protect against spray when beating to windward in rough weather.

The Mast.—21 feet; is stepped 5 feet from bows, midway between the hulls. It is square at the foot, where it is made to slip easily into and out of a black walnut box, 18 inches deep. The latter is mortised to one of the deck beams (second one from the bows), and supported by four iron braces riveted to three of the beams, placed nearer together for that purpose when laid than the three aft beams.

RIGGING.

Length of boom, 21 feet; length of yard, 24 feet. Four blocks only are used, three of them single and one double.

The Sail.—Pattern, modified lateen; dimensions, 28½ square yards. is hoisted by a single halyard, by which alone it is held to the mast above; and below by a stout wooden hoop attached to the boom where it crosses the mast—say 5 feet from the deck—thereby insuring ample head room, and allowing the sail to veer with the wind as freely as a weathercock, which is particularly advantageous in heavy flaws, as it obviates the necessity of luffing to avoid unusual strain upon mast or rigging.

PERFORMANCE.

Capsizing seems to be an impossibility with this craft. So great is her stability that the mast and entire rigging have been blown overboard without so much as stirring a campchair on deck.

Gibing may be simply denominated one of her most innocent performances.

Being wonderfully steady under canvas, by reason of her double construction, she is wholly independent of ballast.

The flat side of the windward boat always acts as a centerboard; and both hulls being closed against the ingress of water, she never requires bailing. Any water she may ship discharges itself at once without doing any harm. Her weight is about 1,500 pounds, and she draws 6 inches of water.

She sails and steers well on all points, and will lay closer to the wind than most ordinary boats, owing probably to the two keels, which give a double hold on the water. On this is largely dependent the ease with which the Ladronia may be put about.

With skillful management of the helm, while close to the wind, she rarely misses stays. A dexterous movement of the tiller at certain points of tacking seldom fails to put her about speedily.

This boat was not built for sea service, but merely to be *safer* and steadier in protected waters than the common open boat. Neither is she suitably rigged for speed, and yet she has repeatedly outsailed the fastest boat hereabouts; one 5 or 6 feet longer than the Proa, carrying double her spread of canvas, and that has always taken the first prize in regattas on this lake.

My object in adopting this style of craft is to render boating here a safe recreation for the ladies of Wells College, who have appreciated, during the past season, the comfort of her roomy deck and freedom from pitching and careening, and my purpose in giving you the result of this experiment is solely that you may call to the attention of your nautical readers a double-hulled boat differing in many particulars from those heretofore introduced into our waters, and whose merits it will always give me pleasure to discuss with *any* of your readers, giving them such further details of construction and performance as may be required.

Aurora, N. Y. T. M. PRENTISS.

PROA LADRONIA—A NEW DOUBLE PLEASURE BOAT.

Recent Progress in Microscopy.

At the second annual reception of the New York Microscopical Society, February 7, the retiring president, Mr. J. D. Hyatt, gave a brief account of the present condition, prospects, and recent progress of microscopy. After referring to the success of the Continental makers of objectives years ago in attaining a certain mediocrity in the manufacture of lenses, Mr. Hyatt said that of late they have been altogether distanced in optical science by English and American opticians. The principal feature of advance during the past year was the celebrated Zeiss oil-immersion objective.

The formula for the Zeiss lens was worked out by Prof. Abbe, of the University of Jena, whose brilliant discovery, in the hands of the expert optician whose name it bears (Karl Zeiss), has startled the microscopical world with results not hitherto obtained, even with Powell & Leland's famous one-fiftieth. According to reliable accounts, said Mr. Hyatt, the performances of this lens are marvelous. It is claimed that the *Amphipleura pellucida* is a coarse test of its remarkable resolving powers, and that it copes without difficulty not only with such tests as Nobert's nineteenth band (118 000 striæ to the inch), but also with 125,000 striæ to the inch, mounted in balsam, in the ordinary manner. This result is obtained mainly by the interposition of a film of oil of cedar wood or some other medium of high refracting index, between the front and the thin covering glass, beneath which the object lies. The film thus interposed is made a factor in the formula upon which the lens is constructed, the great loss of light occasioned by media of low refracting power being thus obviated, and the utmost obliquity of the ray turned to practical advantage. The oil also acts as an elastic front, permits ample space for focusing, and thus renders the collar adjustment unnecessary. Again, the front combination is made active, up to 6° beyond the equator of the sphere, a surface exceeding the hemisphere by about one-twentieth of the sphere's diameter being thus applied as a clear lens. This last feature is rather a curiosity than a novelty, Tolles and others having made use of hyperhemispherical lenses in the construction of high-power objectives.

The greatest success in micrometer manufacture of recent years was accredited to Prof. Rogers, of Cambridge, who, by means of a complicated instrument constructed by himself, has been enabled to lay off lines upon a glass slide at distances apart of one one-hundredth and one one-thousandth of an inch with such accuracy that the deviation is less than one one-millionth of an inch.

SCIENTIFIC TOYS.

The toy shown in Fig. 1 was invented by Mr. J. Pfeiffer, and is amusing and at the same time instructive, as it shows all the principal phenomena of statical electricity. It consists of a plate of vulcanite, about one third of an inch thick, and about half the size of a page of the SCIENTIFIC AMERICAN. One or more small pieces of tin foil about the size of a playing card are pasted on one side of this plate. The vulcanite electrophorus produces electricity with remarkable facility. It is placed on a table, and the surfaces are successively rubbed with the palm of the hand. If the plate is raised from the table and the tin foil is approached by the other hand, a spark from one third to four fifths of an inch long is produced. A number of figures of elder pith complete the toy, and show the phenomena of electrical attraction and repulsion in the most comical manner. The plate being excited, the small elder pith figures are placed on the tin foil, and the plate is lifted from the table. One of the figures will raise its arms, the hair of another will stand out like the bristles of a porcupine, and the third, which is to be lighter than the rest, will perform very laughable movements, and will seem to play with the two pith balls.

Fig. 2 shows electric bottle imps, made by Mr. De Combettes. A cylindrical glass vessel is filled with water, and mounted on a hollow base containing an electro-magnet provided with battery connections. One or two small figures, surmounted by a hollow glass bulb, and having a small piece of wire attached to the feet, are placed in this vessel. The air in the hollow glass bulb will draw them up to the surface of the water, as shown in one of the accompanying engravings, but as soon as the current is passed through the electro-magnet, the figures will be drawn down to the bottom of the vessel. As soon as the current is interrupted the figures will rise rapidly.

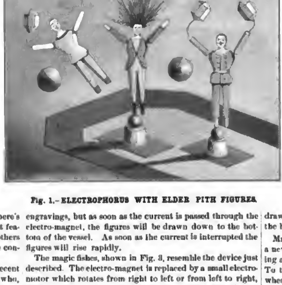


Fig. 1.—ELECTROPHORUS WITH ELDER PITH FIGURES.

Fig. 2.—ELECTRIC BOTTLE IMPS.

The magic fishes, shown in Fig. 3, resemble the device just described. The electro-magnet is replaced by a small electromotor which rotates from right to left or from left to right, and causes a corresponding movement of the fishes in the vessel.

Fig. 3. MAGIC FISHES.

RECENT INVENTIONS.

Mr. Hosea Willard, of Vergennes, Vt., has invented a novel scale beam, the object of which is to facilitate the weighing of articles on the same scale by different systems of weighing—as, for instance, by the ordinary avoirdupois system and metric system, by avoirdupois and troy weights, net and gross weights, etc.

Mr. Michael H. Hagerty, of Brooklyn, N. Y., has patented a glass stopper for milk bottles and other similar articles with a metal eye for the reception of the bail by which the stopper is fastened to the bottle. The stopper has a central depression in which is a metal eye, the shank of which is moulded into the glass stopper in the center of the depression.

Mr. Andrew D. Martin, of Abbeville, La., has patented an improved saddle blanket, which is light, cheap, and durable. The blanket is woven on a hand or machine loom, with strands twisted out of black Spanish moss. The warp is of sufficient length for a number of blankets, and the weft is interwoven with it, and the blankets are cut off at the desired length when completed. A strand of cloth is woven in between the weft at the ends of each blanket, and one or more strands of cloth or some similar material, are woven into the middle of the blanket. The edges of the blanket are trimmed with a binding of cloth, leather, or oilcloth.

Mr. William H. Allen, of New York city, has invented an improved machine for weighing grain and other substances as they flow from a spout, discharging them in uniform quantities into a hopper or other receiver, and registering the weight of the substance discharged.

An improvement in washing machines, patented by Mr. George W. Dorris, of Elgin, Texas, consists in combining a lower cylinder having longitudinal spiral grooves with an upper cylinder having longitudinal straight grooves and holes.

An improved apparatus for refining camphor has been patented by Mr. William V. McKenzie, of Rahway, N. J. The method of using this apparatus consists in placing the crude camphor upon the diaphragm in a suitable covered vessel, and introducing steam of proper temperature from a boiler into the chamber below the diaphragm to cause the camphor to evaporate or sublime. The moisture or a portion of it contained in the crude material passes off as steam through an aperture in the cover, while the camphor sublimes or evaporates and collects upon the under side of the cover in a solid cake that may readily be removed by slightly heating the cover. The impurities of the camphor remain behind on the diaphragm.

A safe, easily-operated, and strong device for fastening the ends of the traces to the single-tree, has been patented by Mr. Millard M. Bowins, of Bowinsville, O. The device consists of a flat metal spring attached to the back edge of the single-tree, and provided with a notch which receives the edge of the end of the trace, and, together with an adjacent notch in the single-tree, holds the end of said trace on the single-tree.

Mr. Dennis Harrington, of New York city, has patented a device for transporting or moving live stock on foot through the streets of a city. It consists of a pen without a floor, mounted on wheels, and arranged to be drawn forward by animals. By this arrangement stock can be moved through the streets of a city with perfect safety to the inhabitants, as it is impossible for the animals to escape from the moving pen.

Messrs. Samuel Mart, of Sutton at Hone, County of Kent, and Charles W. Bradley, of York Street, County of Surrey, England, have patented apparatus for heating or cooling water and other liquids wherein the water is circulated in tubes within a heating or cooling space and drawn through a pipe as desired for use. In heating water the inventors make use of gas burners to which the gas is turned on when required by a cock, which also supplies gas to a pilot burner that burns continuously to maintain the heat and keep up a circulation. The gas cock is combined with the water supply pipe in such a manner that a single handle is made use of for regulating the gas supply, the supply of water to the boilers, and the delivery of the hot water. The hot water is delivered by a rising pipe above the heater, into which the hot water is forced by the pressure when the water inlet to the heater is opened. In cooling water, ice is substituted for the burners.

An animal poke, patented by Mr. James T. Camp, of La Fayette, O., consists of a bow to place over the animal's neck, in which are pivoted the ends of two bars, one above the other. The pivoted ends of the bars are provided with cams, so arranged that by pressure on the lower bar the poke is spread open. The free end of the lower bar, when it is drawn down, throws the free end of the upper bar up against the head of the animal.

Mr. George W. Ebright, of Waynesville, O., has patented a new, simple, and amusing toy, consisting of a box containing a slide provided with a rubber or other suitable spring. To this slide a goat or other animal is fastened, which, when the spring is pulled, butts against the figure of a boy on the front part of the box.

Mr. Washington Irving Marsh, of Northville, Mich., has patented a device for preventing the ends of the whiffletree from catching upon or striking against any objects. It consists of a plate of wood or metal attached to the trace of a harness just in front of the cock eye, and extending rearward past the hook and end of the whiffletree.

Messrs. James W. Gault and William A. Forman, of Murphysville, Ky., have patented an improved elevator for hoisting tobacco plants and leaves and suspending them upon the rails in drying or curing barns. This device can easily be worked by one person, and by it the tobacco sticks can easily be hung six inches apart, or closer, if desirable, thus economizing all the hanging room in a curing barn.

Mr. John H. Yates, of Sharon, Wis., has invented an improved nasal inhaler, which is simple, convenient, and so arranged that the air can circulate very freely through it before being inhaled. The invention is an improvement on the inhaler for which letters patent No. 167,209 were granted to Mr. Yates and Mr. Charles R. Treat, dated August 31, 1875.

Mr. John Toler, of Newark, N. J. has patented an improved furniture caster. The object of the invention is to provide a solid bearing in a two part caster socket for the conical head of the caster spindle, and to secure the spindle in said two part socket without the use of screws or rivets.

A simple and effective bag tie that cannot accidentally become unfastened, has been patented by Mr. Moses Y. Hall, of Vinal Haven, Me.

Mr. Johnson H. Beard, of Providence, Ky., has patented a portable fireplace that is self-supporting when it is set up, and does not require external support to give it stability.

Mr. Henry Shulenbarger, of Smithville, O., has patented an animal trap that will catch the animal before it has an opportunity to eat the bait, and will also set itself automatically after being sprung.

Mr. Michael Limpert, of Pittsburg, Pa., has patented an improved heating attachment for cars and other vehicles, so constructed as to heat the floor of the vehicle and at the same time introduce a supply of warm fresh air.

Mr. Alfred N. Lovelace, of Knoxville, Tenn., has patented a trap for the flies, moths, and other insects that are destructive to bees and to vegetation, and that produce the larvæ destructive to tobacco, cotton, etc.

Mr. Ezra W. Savage, of Ashtabula, O., has patented an improved sap spout, by which the sap bucket may be held to a tree without injury to the bucket. It consists of a latch pivoted to the front end of the spout and a hook formed on the under side, so that by the combination of the two a sap bucket may be firmly held.

Mr. Morris F. Bell, of Fulton, Mo., has patented an improved adjustable rocking chair. The seat and back of the chair are continuous, and composed of thin transverse strips of wood or other suitable material, riveted on two or more longitudinal flexible bands of metal. One end of these bands is secured to the head piece, while the other is fastened to the front piece of the seat. Thus both back and seat are made flexible and capable of conforming to the shape of the occupant.

A self-closing bottle stopper, patented by Mr. James J. Allison, of Nelson, Ill. consists of a wire doubled to form a median loop or eye, and provided with elastic arms passing through stopper and having hook ends bent toward each other.

Mr. Louis B. Denison, of Delaware, O., has patented a tripod head for leveling instruments. In this device there are two sets of leveling screws, and the motions produced by them are independent of each other, so that when the instrument is leveled over one set it remains so while being leveled over the other set. By this independence of motions the binding of the leveling screws, that is so common with ordinary tripod heads, is entirely obviated; and as the binding of the screws is a source of a great deal of trouble to the operator in many ways, both because of the consequent breaking of the screws and because of the straining of parts of the tripod head, the entire removal of such troubles by the use of this device will recommend it to all who use leveling instruments.

Mr. James N. Winn, of Darien, Ga., has patented car couplings which are so constructed that they may be moved up and down to adapt them to couple with cars higher or lower than those to which they are attached.

Mr. John Kirkland, of Menomonee, Wis., has invented an improved spark arrester of the class in which plates, disks, or other devices are placed within the smoke stack for the purpose of detaining the sparks and cinders until they are consumed or extinguished.

An improved cloth cutting knife for cutting several thicknesses at the same time, has been patented by Mr. Nathan Rubenstein, of Chicago, Ill. The invention consists in a knife, the cutting edge of which is inclined downward toward the center of the blade and is then inclined upward to the lower end of the blade in a wave line, thus forming a shoulder at about the middle of the cutting edge.

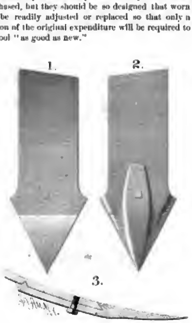
Mr. John M. Axtmann, of New York city, has patented a new and improved attachment for transoms, by means of which they can be conveniently opened and held in the desired position. It consists in a curved lever pivoted to a bracket secured to the door frame, and having one end pivoted to a pitman rod provided with a handle or knob, and the other end provided with a stud which passes into a slot in an angle plate securely attached to the hinged or pivoted transom.

The Industrial Population of France.

According to the *Annuaire Statistique* recently published by the French Minister of Agriculture and Commerce, the total population of France, a little under 37,000,000 in round numbers, is divided into 12,000,000 inhabitants of towns and 25,000,000 inhabitants of the country. On eliminating from the general total 860,590 individuals (who are soldiers, sailors, students in schools, infirm and diseased, prisoners, or monks not giving instruction), the total of a little over 36,000,000 of persons participating fully in social life comprises, with regard to means of existence and professions, 210,200 persons without known professions; 71,300 vagabonds and mendicants; 2,151,900 stockholders (including 195,000 pensioners of the Government); 1,531,400 persons exercising liberal professions or living by them; 3,837,200 persons engaged in trade, transport, and navigation, or living on their products; 9,274,500 persons engaged in various industries, or living by them (6,000,000 in small industries, 3,000,000 in mining and manufactures); 18,968,600 persons practicing agriculture, or living by it (of whom 10,500,000 are proprietors of their land, nearly 6,000,000 are tenant farmers, 2,500,000 are agricultural specialists, comprising vine growers). On entering into detail of each of the great branches of the national production, it is found that 4,000,000 of proprietors or agricultural tenants (of whom 400,000 are women) employ: as clerks, 82,000 men and 54,000 women; as workpeople, 590,000 men and 378,000 women; as day laborers, 922,000 men and 704,000 women; as domestics, 661,000 men and 663,000 women; and, on the other hand, that the families maintained by the landed property or agricultural work consist of 8,800,000 persons of masculine sex, and 7,200,000 of feminine; 1,125,000 industrial patrons (of whom 226,000 are women) have for clerks 143,000 men and 50,000 women; 1,555,000 workmen and 1,000,000 workwomen; 305,000 male day laborers and 244,000 female; 78,000 male domestics and 143,000 female. The families living by industrial operations embrace nearly 1,600,000 persons of masculine sex and 3,000,000 of feminine; 784,000 employers in trade and carriage (of whom 221,000 are women) have 247,000 male *employés* and 71,000 female; 198,000 workmen and 56,000 workwomen; 140,000 male day laborers and 80,000 female; 65,000 male domestics and 188,000 cooks or nursery maids. They support families amounting to 661,000 boys and 1,346,000 girls.

IMPROVED SHOVEL PLOW POINT.

The profits of the agriculturist depend largely on the perfection and adaptability of his implements, and it is not only necessary that the implements be perfect as they are purchased, but they should be so designed that worn parts may be readily adjusted or replaced so that only a small portion of the original expenditure will be required to make the tool "as good as new."



BEEBE'S SHOVEL PLOW POINT.

The invention represented by the accompanying engraving is intended to render a very important class of agricultural tools more useful and more durable than those of the usual construction. Fig. 1 is a face view of the share, having the point attached; Fig. 2 is a back view, and Fig. 3 is a longitudinal section showing the joint between the share and point. The point, as will be observed by referring to Fig. 3, is hooked over the beveled end of the share and is held firmly in place by a single bolt and by a short dowel pin. The point may be readily removed and replaced when worn or broken, at a cost that is slight when compared with that of the entire shovel, and when the point needs sharpening it may be removed and sharpened without injuring the temper of the share.

It is stated that in the long run this share with its point is much cheaper than the ordinary kind, and is capable of doing better work. It may be adapted to local peculiarities of soil and to different kinds of work.

Mr. H. C. Beebe, of Canton, Fulton county, Ill., is the inventor of this useful improvement.

Wheat Heaters.

Perhaps no device has come into such wide use among our millers, in so short a time, as our steam wheat heaters. A very short time ago the heating of wheat by steam was almost or altogether unknown, while now hundreds of mills are using them, and scores are sold every week. An unsophisticated person, on entering a mill and finding the wheat heated to a very moderate degree, but little above blood heat, in fact, might have serious doubts as to whether any advantage was gained by the procedure; but the experienced miller's observation has taught him that the benefit derived from heating wheat by steam is of a very substantial character.

Hard, dry wheats have always been difficult to mill properly and still obtain a good yield. In grinding such wheats, if the outer covering is dry and brittle, it cannot well avoid being abraded more or less, and the tiny particles of bran rubbed off in the grinding are so thoroughly mixed with flour that a separation is impossible, seeing that the comminuted particles of bran are of about the same size as the flour particles, and will pass through the same numbers of bolting cloth. It was this observed fact that led millers to adopt some means of toughening the bran before grinding, and the first and simplest means seemed to be to wet it. This practice is still largely followed by European millers, but there are very serious objections to it, not the least of which is, that wetting the wheat spoils the keeping properties of the flour. Some genius noted the fact that dry, hard wheats could be ground and bolted more easily in hot weather than in cold, and reasoned that the only reason could be that the wheat was warmer. Of course this would seem paradoxical, for on first sight it would appear that the original trouble with the wheat was, that it was too dry, and that any more heat would make it still drier, and therefore more unsuitable for milling. A little reflection will show, however, that additional heat, while drying out the interior of the berry, draws the moisture to the surface or bran, and therefore attains the purpose of wetting the wheat while avoiding the disadvantage of the latter; for by drawing the moisture to the bran, the "keeping" properties of the interior portion of the berry are enhanced.

The advantage of using wheat heaters is manifold. One great object gained is, that the wheat is ground and bolted at about the same temperature the year round, and trouble and annoyance with the bolts is largely or completely avoided. The toughening of the grain coating renders broad bran possible, and therefore the flour will have fewer specks. Most millers agree that there is an appreciable saving of power in grinding wheat that has been previously passed through a heater, and another advantage which very many have noticed is, that when heated, hard and soft wheats blend more easily in grinding. All these things are certainly sufficient to entitle the wheat heater to a permanent place among our mill machinery, and account for the large numbers of them that have been sold in the past two years.—*American Miller.*

Sun Spots.

The sun is becoming an object of great interest to observers, as the minimum sun spot period is drawing to a close. During the greater part of the winter spots have been visible on the sun's face. An observation made yesterday revealed three widely separated spots or groups, forming an immense triangle. Two of these spots were quite large, and surrounded with broad penumbræ. These spots were very black. The presence of spots on the sun can be easily ascertained without danger to the eye, by those possessing telescopes of even moderate power. Let a broad, round, pasteboard screen, with a hole in the center for the eye piece to pass through, be attached to the telescope. In the shadow of this screen, and about two feet or eighteen inches from the eye piece, place a white paper screen. The screen can be supported by a very simple contrivance, so it shall be nearly at right angle to the telescope tube as directed to the sun; or a paper may be pinned to the side of a building, if no great accuracy is desired. An eye piece magnifying from twenty to a hundred diameters is best for the purpose. Throw the sun's image on the screen so the edge shall appear sharp as it crosses the field of the telescope. The dark spots which move across the screen with the sun's image can be readily detected and carefully focused, so their full outlines will appear, provided the magnifying power is sufficient. This is a safe way of observing sun spots, and it requires but little preparation. A better way would be to throw the image upon a white surface at the bottom of a funnel. But this funnel must be attached to the telescope, or so mounted as to move with it in following the sun. An equatorial mounting is the best for the purpose. The eye piece should be mounted in brass, as rubber or other light material is liable to take fire. By the use of a low power eye piece the telescope may be readily placed upon the sun. This accomplished, a higher power may be applied.—*Rochester Democrat.*

Theory of Life.

The late Professor Faraday adopted the theory that the natural age of man is 100 years. The duration of life he believed to be measured by the time of growth. In the camel the union takes place at eight, in the horse at five, in the lion at four, in the dog at two, in the rabbit at one. The natural termination is five removes from these several points. Man being twenty years in growing lives five times twenty years—that is, 100; the camel is eight years in growing, and lives forty years; and so with other animals. The man who does not die of sickness lives everywhere from 80 to 100 years. The professor divides life into equal halves—growth and decline—and these into infancy, youth, virility, and age. Infancy extends to the twentieth year, youth to the fiftieth, because it is in this period the tissues become firm, virility from fifty to seventy-five, during which the organism remains complete, and at seventy-five old age commences to last a longer or shorter time as the diminution of reserved forces is hastened or retarded.

Winter Cotton in Georgia.

The turn out of the cotton crop of this region is simply astonishing. Many farmers are now gathering several hundred pounds a day. It seems as if every boll will open. The mild weather of the winter has been a godsend on this account, for it has given every farmer many more bales than he thought it possible for him to get at the beginning of the season. We heard one man say he had lost three bales by plowing up a field too soon to sow in wheat. It is a novel sight to see cotton picking going on the last of January. The cotton is stained and classes low, but it pays better than the good grades did last year.—*Oglethorpe (Ga.) Echo.*

THE HAIRY CRAB.—(*Dromia vulgaris*.)

This crab belongs to a class which forms one of the connecting links between the crab and the lobster. The last pair of legs are perfectly useless for walking, and are modified into a pair of appendages by means of which the animal is enabled to cling to an object very firmly. The body is covered with hairs, generally filled with such a mass of seaweeds and dirt that it requires a good washing to show the real color of the animal. The peculiar habit of this crab is to drag along some kind of sponge, generally a *Tragus spinosulus* or a variety of *Suberites domuncula*, on its back, and to hold it by means of the deformed pair of legs. It uses this sponge to conceal itself, and only drops it when pursued.

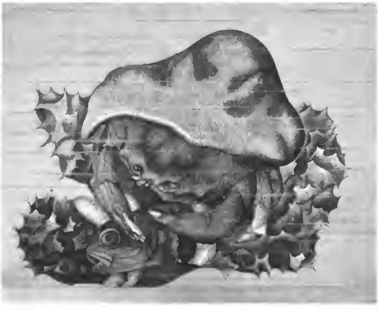
The Touracou.

This curious bird, the touracou (*Turacus albocristatus*), is one of the plantain eaters. This bird has bright red feathers in its wings, the red coloring matter of which is soluble in water, so that the birds are apt to wash their red feathers white when in confinement. The coloring matter, "turacin," as was discovered by Prof. A. H. Church,* is distinguished by yielding a remarkable absorption spectrum, and contains a considerable quantity of copper.

The bird is very common in the Kuysna, and I was told by sportsmen who had shot it, that in rainy weather it will hardly fly, but crouches down under the bushes, and may sometimes be knocked down with a stick.

A most extraordinary statement concerning these birds, to the effect that the red color, when washed out of the feathers, becomes restored, is made by M. Jules Verreaux.† It seems impossible to understand how this can happen, since there seems no means by which the coloring matter can be conducted from the body of the bird to the web of the feather.

Such a result seems only possible in hornbills, some of which, as is well known, paint their feathers yellow by rubbing in a yellow secretion discharged from glands under the wing. M. Verreaux states that in rainy weather, just as I was informed, the touracous get their feathers wet through, and are, in consequence, unable to fly, but crouch on the ground, instead of resting on the tree tops as usual. He caught several with the hand; the color came out on his hands from the wet feathers. He washed the color out of their wings with soap and water till the feathers were almost white. The bright red color, however, returned directly the feathers were dry, and this occurred even when the same bird was washed twice in the same day. The red coloring matter is scarcely at all soluble in pure water, but the addition of the slightest trace of alkali to the water enables it to extract the pigment from the feathers, and yield a blood-red solution.—*H. N. Moseley, Challenger Notes.*



HAIRY CRAB (*Dromia vulgaris*) COVERED BY A SPONGE (*Suberites domuncula*). NATURAL SIZE.

Sugar Beet Industry in Delaware.

The Legislature of Delaware in 1876 appropriated $300 toward the encouragement for the growing sugar beets within the State, and subsequently increased the appropriation to $1,500, and a commission of three well known citizens of the State were appointed to disburse the appropriation by offering premiums to the growers of beets, and otherwise promoting the new industry. To this end the commission obtained pure imperial sugar beet seed from abroad, which they distributed to farmers who desired to raise them. With the seed were furnished documents containing instructions as to the character of the soil needed and its preparation, the time of planting, cultivation, and harvesting, also copies of the following conditions as the principal ones to be observed: "Select a suitable soil; use fertilizers or well rotted manure; deep plowing in the fall or early spring; straight rows, close together, and plenty of seed; early and frequent working and careful thinning to one beet in a place; place one beet to every 120 or 200 square inches, which will give from 30,000 to 50,000 beets per acre, which, in rich land, will weigh from 1 to 2 pounds each."

The action of the commission induced a large number of farmers in Delaware to commence the culture of the sugar beet as an experiment, and premiums were awarded for the growth of 1878 to twenty-two farmers in Kent county, ten in New Castle county, and one in Sussex county. The reports from the various parties contain a description of the soil, the time of plowing, and the mode of cultivation. The premiums for the growth of 1879 were $100 for the best one acre and upwards grown under contract; $75 for second best; $50 for the third, and $25 for the fourth. This action of the commission stimulated the farmers, and, according to the Philadelphia *Ledger*, from which we derive our information, during the past year from 75 to 100 of them, principally in Kent and New Castle counties, cultivated the beet with an aggregate production of about 600 tons. The result of the experiment was considered so favorable that a company was formed under the name of the Delaware Beet Sugar Company, to erect a factory for the purpose of manufacturing sugar from the beet. A lot was purchased on the line of the P. W. and B. R. R., four miles north of Wilmington, and about six months ago a brick building was erected in which the work was to be carried on. About four months ago the machinery necessary for the operation was set in motion, and since that time has been in constant operation.

The method adopted for the manufacture of the sugar is known as the diffusion process. The beets are first placed in a cylinder of wood, with slight openings, and thoroughly washed, after which they are conveyed by an elevator to the second story and emptied into a cutting machine, where they are cut into thin slices, and from there carried by another elevator into the diffusion battery. This arrangement consists of eight iron tanks, each holding about 1,500 pounds of cut beets, into which the water is introduced. The water is started in one of the tanks, and, after passing through it, is conveyed to the outside by means of pipes, which connect all the tanks, so that the water from the first tank flows through each, thus absorbing all the sugar possible. When the water has thus become impregnated it is shut off, and the juice, as it is now termed, is withdrawn and conveyed to larger iron tanks, where lime is introduced with the juice so as to absorb its impurities. Carbonic acid gas is then introduced to precipitate the lime, after which the production is run through bone-black to clarify it. From these tanks the juice is passed to a steam pump, where it is forced to the filter presses, which still further extract impurities. From here it is conveyed into the vacuum pan, where it is concentrated almost to the crystallization point.

After having passed through this process, the juice is placed in iron wagons and run into a room with a temperature of about 125°, where it remains from four to five days, when it is ready for the last process, which consists in passing the juice through a centrifugal machine. This revolves at the rate of 1,500 revolutions per minute, and from one end runs the molasses or sirup, and from a box a dark yellow substance, known as raw sugar, is taken, and which is sold to the refiners.

The capacity of the present works is 25 tons of green beets per day, but it is expected to increase them to 200, as the cultivation of the beet increases throughout the State. The product so far has been from 8 to over 18 tons per acre, and the price realized was about $4 per ton. After extracting the sugar from the beet, the pulp is sold to farmers at $1 per ton, and used by them as food for cattle. The only other establishments now making sugar from beets is one in Maine and one or two in California.

Fast Horses.

The running horse in this country is not so valuable as the trotter. Pierre Lorillard paid $18,000 for the famous runner Falsetto, three years old, recently sent to England. Mr. Keene paid $15,000 for Spendthrift. When we come to the trotters we find the prices up. Mr. Bonner paid $40,000 for Pocahontas, $36,000 for Rarus, $33,000 for Dexter, $20,000 for Startle, $16,000 for Edwin Forrest, and $15,000 for Grafton. Mr. Smith, of New Jersey, paid $35,000 for Goldsmith Maid, $32,000 for Jay Gould, $30,000 for Lady Thorne, $25,000 for Lucy, and $17,000 for Tattler. Mr. Vanderbilt paid $21,000 for Maud S., and $10,000 for Lysander Boy. The largest sum ever paid for a horse in England, where they have few trotters, was close on to $72,000, paid for Doncaster by the Duke of Westminster.

New Method of Extracting Plant Perfumes.

The *Revue Industrielle* states that M. Camille Vincent, who has already created two industrial applications of the chloride of methyl derived from the residue left in the manufacture of beet sugar, has, in conjunction with M. Massignon, discovered still another. Seeing that this substance had the property of dissolving fatty bodies, resins, and essential oils, these gentlemen were led to consider why it might not be made available for the extraction of the odoriferous principles of plants. The first experiment, made upon odorous woods, was successful, but gave a product which had a disagreeable smell, owing to the fact that the commercial chloride of methyl employed contained traces of a pyrogenous matter with a very persistent odor. M. Vincent, therefore, purified the methyl by means of concentrated sulphuric acid, and obtained a product entirely free from disagreeable odor, and having the property of dissolving perfumes and giving them up again, on evaporation, with all their fragrance. A trial was made with orange flowers in a glass apparatus, and a product obtained which was asserted by several perfumers to be much superior to the neroli obtained by distilling the flower with steam. After these first encouraging experiments, an apparatus of modest size was constructed for the purpose of ascertaining the industrial value of the new treatment by operating at one time on several pounds of flowers and different plants. This apparatus, which has now been working with great regularity for several months, consists of: (1) A digester in which the plants are placed; (2) a reservoir of liquid chloride of methyl; (3) a closed vessel in which is received the chloride charged with the principles derived from the odoriferous plants, and in which, by means of a pump, the same is vaporized; (4) of a pump for creating a vacuum above the chloride to be vaporized, and for compressing the vapor into a serpentine liquefier, from whence the liquefied chloride returns to the reservoir. The latter portion of the apparatus is the same as the ice machine of which we have already spoken in a previous number. In extracting the perfumes, the digester is filled with the flowers, the apparatus is closed, and then by means of a faucet the liquid chloride is allowed to flow into vessel No. 2. Here digestion is allowed to take place for two minutes, and the liquid loaded with the perfume is drawn off into vessel No. 3. Then a new charge of chloride is passed over the flowers, and this is repeated several times. Finally a vacuum is created in the digester to remove the chloride which has taken up the perfume, and it is forced into the liquefier; then a jet of steam is passed through the exhausted mass in order to drive off the chloride which is retained by the small quantity of water contained in the flowers, and the damp gas is collected in a gasometer. The liquid charged with perfume and contained in vessel No. 3 is evaporated in a vacuum. On opening the vaporizer at the end of the process, the perfume is found, mixed with fatty and waxy matters. This mixture, treated with cold alcohol, gives up the perfume with all the fragrance and sweetness that it possessed in the plant. M. Massignon's works are prepared to treat 2,200 lb. of flowers per day. This new manufacture makes the third industrial application of chloride of methyl (as before stated), the other two being the manufacture of methylated products and the production of ice.

THE PHYLLOXERA IN CALIFORNIA.

It appears from an article in Prof. Riley's new journal, the *American Entomologist*, that the phylloxera has established itself in the Sonoma Valley of California, and destroyed hundreds of acres of vineyards, while only a few miles distant, in the most important wine district of the State—the Napa Valley—not a single case of phylloxera has been detected. "It is," remarks Prof. Riley in commenting on this singular fact, "fortunate for the California grape-grower that the insect has, to all appearances, there undergone a considerable modification in habit, which very much limits its destructiveness. It is steadily spreading from infected centers, but very slowly indeed, compared to its spread in France. Prof. E. W. Hilgard writes that he believes this is due to the non-appearance of the winged female, as he has not been able to obtain it. If such is the fact it is one of the most curious modifications in habit, as a result of climate, that is on record, and will go far to explain the immunity in the Napa Valley while the Sonoma Valley is being ravaged, and the fact that the insect has not appeared in other parts of California. It also offers an additional incentive to grape-growers in other sections of the State to exercise the utmost vigilance to prevent the introduction into their own locality of infested vines or cuttings. That the species may exist for an indefinite time without the winged female seems highly probable from the fact that the sexual individuals may be produced from hypogean females as well as from aerial ones. Yet so singular a change in the insect's nature can only be accepted upon the most thorough and satisfac-

* Researches on Turacin, "Phil. Trans.", 1870, p. 627.
† M. Jules Verreaux, "Proc. Zool. Soc." 1871, p. 40.

tory evidence. This is easily obtained by half filling large glass jars with badly infested roots, interspersed with a little soil, about the time or some time before the grapes begin to ripen. If there are pupæ upon such roots the winged females will soon begin to appear on the side of the jar toward the light."

One of Prof. Riley's correspondents, who has large interests in Californian grape culture, and who has recently returned from an extended visit to the richer wine producing sections of the State, says that the insect has been established in the Sonoma Valley for the last five years, and is now working there with terrible effect. No one in this valley seems able to give any suggestion as how the pest may be successfully fought. Every variety of vine planted in the valley has been attacked and destroyed, or is being destroyed.

ENGINEERING INVENTIONS.

Messrs. John Maguire and William A. Alexander, of Mobile, Ala., have patented improvements in vessels and apparatus for river and harbor dredging, wherein pumps are made use of for elevating the material from the bottom. The inventors make use of a vessel of suitable dimensions, formed with a central well and water ballast compartments, whereby the vessel may be sunk to the bottom. The vessel is also fitted with pumping apparatus, whereby the water in the space inclosed by the well is first to be pumped out, and the mud, sand, etc., of the bottom then pumped out to the desired depth. Within the well of the vessel is a frame fitted for being raised and lowered, and carrying discharge nozzles of a second pumping apparatus, whereby streams of water are discharged for agitating the mud, etc., and rendering it semi-liquid, so that it may be pumped out. These discharge nozzles are fitted upon carriers that are movable upon slideways, whereby all portions of the inclosed bottom may be subjected to the action of the water.

Mr. John H. Wait, of Opelika, Ala., has patented an automatic railway switch, that may be operated by the wheels of the passing locomotive, or by means of levers attached to the locomotive or one of the car trucks. The invention consists in a combination of pivoted rails, levers, and locking devices, which cannot be fully explained without engravings.

An improved process and apparatus for sinking piles has been patented by Mr. Henry Case, of Brooklyn, N. Y. The object of this invention is to sink piles for submarine or other foundations without the aid of pile driving machinery, and to secure good bearings for the piles at proper depths.

An improved car brake and starter has been patented by Mr. John L. Cole, of Williamstown, Mass. The improvements relate to apparatus for checking the momentum of railroad cars and storing power to be subsequently used in starting or impelling the car. The apparatus consists, generally, of springs, a cord or chain, a conical spirally-grooved winding drum, and gearing and clutches for connecting the drum with the car wheels or axle, whereby the cord is wound on the drum, the springs compressed and held for use in propelling the car by their expansion. The invention has certain novel features of construction and combination of mechanism by which the propulsion of the car in the proper direction by the springs is obtained and the compression of the springs by the momentum of the car is arrested at a definite point, and the mechanism is automatically thrown out of gear when the momentum is arrested, and also when the springs have expended their force in starting the car. It may also be thrown into and out of gear at any time by the driver.

ARTESIAN WELLS FOR COLORADO.

The Committee on Public Lands has reported favorably the bill introduced by Senator Hill, of Colorado, providing for an appropriation of $50,000 to be used in sinking artesian wells in the arid regions of the Rocky Mountains.

It is estimated that there are in those regions five hundred million acres of government lands, now unsalable because of their aridity, which could be converted into valuable farming lands by irrigation, and that such artificial watering is entirely feasible by means of artesian wells. The government is asked to pay the cost of the experimental proof of this position because it owns the land, and private enterprise cannot be expected to undertake its improvement. It is asserted, however, that having demonstrated the possibility of reclaiming such lands, the government will have no difficulty in selling the land to men who will go on sinking wells at their own cost. Mr. Hill's bill provides for the sinking of five wells, two on the east and three on the west of the Rocky Mountains, the sites to be selected by the Secretary of the Interior.

A New Way of Studying Sounds.

The London *Times* reports that a new and simple way of producing colored rings, which seems capable of some interesting applications, has been recently brought to public notice by M. Guébhard. A saucer filled with not very pure mercury is all the apparatus required. Then clear off with a piece of card or paper the thin pellicle of oxide and dust, breathe on the bright surface, and a magnificent system of colored rings is given by the film of condensed moisture then formed. Instead of the four or five "irises" described by Newton, six or seven can be well made out, and the thickness of the film increasing from the border inwards, the order of hues is reversed. Still better effects can be got by dropping volatile substances (as petroleum oil) on the mercury surface, instead of breathing on it; but the most remarkable results are had with collodion. Diluted with ether, this gives pellicles on the mercury, which may be detached (after their thickness and colors have been regulated at will) and transferred to paper. M. Guébhard has utilized these effects in study of the sounds of the voice. Vowel sounds uttered above the moistened mercury surface produce characteristic ring figures which throw new light on the nature of the vibrations involved. The vibratory state, indeed, for vowel sounds, appears to be often very complex, the figures presenting groups of several ring systems, indicating several centers of percussion.

"Prospecting" Metal Veins by the Induction Balance.

A correspondent of the *Electrician*, referring to the reported invention of a method for detecting and tracing veins and lodes of metals in the earth by means of electricity, says there has been suggested to him the application of the induction balance of Professor Hughes to the purpose. It is well known, he adds, that the balance is extremely sensitive to the neighborhood of metals, and it becomes a question worth settling by experiment whether this sensibility could not be employed as a means of indicating the presence of metalliferous ores underground. The obvious mode of applying the apparatus would be to separate the two induction pans of the balance to such a distance apart that, while one of them was brought under the influence of the concealed metal, the other would be comparatively unaffected. This could be done, perhaps, by elevating the balance vertically on a pole or standard, to be carried about by the prospector, so that one pan was brought near the surface of the ground, while the other was raised above it to a considerable height, say, of ten or twelve feet. On a balance being obtained in a proper locality the search could begin, and the presence of veins under foot might be found to reveal itself by disturbing the balance. A better but more inconvenient plan, from its rendering it necessary to pay out a portable line or wire,

would be to keep one pan of the balance stationary in one place, while the other was being moved about so as to feel for the hidden ores. The latter method is shown in the accompanying sketch, where A is the stationary pan of the balance, and B is the movable pan carried by the prospector; C is a metal lode under the surface, D is the battery, and K is the key in the primary circuit of the balance, and T is the telephone in the secondary circuit.

While moving over the ground the prospector makes and breaks the primary circuit by means of the key, and listens in the telephone for any sound indicating that the equilibrium of the induced currents has been disturbed. Should the balance prove sufficiently sensitive, it can, of course, be used for similar and allied purposes in mining and boring operations, so as to trace the positions and roughly determine the richness of metal veins, ores, and other conducting minerals, such as coal, graphite, etc. The first plan would probably answer best in cases where the metal was at or near the surface, as is the case in "surface diggings."

Job Shops and Slop Shops.

A writer in the Boston *Journal of Commerce* pictures the difference between a well organized job shop and what he terms a slop shop, as follows. The job shop is *sui generis*. While it partakes of the character of those adapted and intended for special productions, it has a character of its own not shared by any other. The various jobs and the frequent make-shifts tend to produce what would seem to the unpractical eye an appearance of disorder, and would convey such an impression, possibly, to the experienced mechanic, who might be unacquainted with the methods and system of that particular shop. But the well arranged job shop has an all-pervading character of order in the seeming disorder, and its workmen waste little time in preparing for emergencies, and are usually ready for any job that comes up.

The slop shop is exactly the reverse in character, and is never just ready for an unexpected job. Its apparent character is its true one. An outsider could just as readily find a missing tool or designate the hiding place of a needed appliance as the proprietor, foreman, or any one of the workmen. The floor is rarely swept; when the debris of work accumulates too much in one spot, it is spread by a few hasty kicks, and all is serene. There are "glory hole corners" under the benches which rarely are overhauled. There are hiding places for spoiled jobs which are inquired for by the vexed foreman, but rarely found. The shafting welcomes the visitor with a beseeching squeak, the repetition of which finds an echo in the chafing of a lathe belt on the cone. Some of the belts show angular gaps across their face, premonitions of sudden partings and telltales of neglect. The workmen are lavish with oil and waste, put new files on cast iron scale, toss a broken tool under the bench, and if they get hold of a decent tool, in decent order, chuck it into their private drawer or locked box. If a drill is wanted for a three-quarters of an inch hole, one sized to thirteen-sixteenths is taken and ground to size. Possibly half an hour after it has been transformed another workman needs it on work for thirteen-sixteenths holes. So the drills can never be kept in sets and sizes, and when account of stock is taken at the end of the year the proprietor wonders what has become of the sets of drills with which he started off so sanguinely and hopefully the preceding January.

This is the general practice in the slop shop. There is no real head to the concern, there are no Mede and Persian rules of order, no sharp, overseeing eye, and no developed and vitalized system. A job that should be drilled under the upright drill is taken to the lathe because the former is in use, and a workman is put to a three hours' job of chipping and filing because another is using the planer. In this shop there is manifested little readiness among the workmen to assist each other, except to help in turning the shop into a "hurrah's nest." If one man knows more than another he will hold on to his knowledge very much as a miser clings to his pennies. The foreman, possibly, gives instruction but grudgingly or with an air of reproof. The slop shop is a good place to leave a job, but it is a poor place from which to get the completed work. The foreman will promise readily enough to-day, but his performance and day of redemption are indefinite.

There are plenty of these slop shops all over the country. It is singular to note that, although the proprietors invariably fail in business, there are about so many all the time; soon as one drops out another is anxious to show how little he knows about the management of a business, and the slop shop is probably a permanent institution.

Hydrocellulose in Photography.

M. Aime Girard has communicated to the Photographic Society of France the following note on the employment of hydrocellulose in preparing photographic pyroxyline. "Whenever cellulose ($C_{12}H_{10}O_{10}$), in any form, is submitted to the action of concentrated acids, it is dissolved, and by taking up two equivalents of water is transformed into glucose ($C_{12}H_{12}O_{12}$). But previous to this saccharification, an intermediate stage may be observed, where only one equivalent of water is taken up, and a new compound is formed to which the formula $C_{12}H_{11}O_{11}$ is attributed. This compound, to which I have given the name of *hydrocellulose*, is not soluble in the acids, and provided that care be taken in the manipulation, it still possesses its original external form; but so soon as it is touched it will be found to have lost all its power of cohesion, and to fall away to an almost impalpable powder. Hydrocellulose possesses a number of chemical properties of its own, but it keeps also some of the properties belonging to ordinary cellulose. Among the latter is its capability of being nitrified by a mixture of nitric and sulphuric acids, and of being by this means transformed into either explosive or soluble pyroxyline. In this way we can prepare either explosive or soluble pyroxyline in the state of a fine powder. The manner of preparing it is precisely similar to that of preparing pyroxyline from cellulose, but in this case the product, when rubbed in a mortar, is at once reduced to an exceedingly fine powder. This powder, dissolved in a mixture of alcohol and ether, gives a collodion whose value to photographers it will be most interesting to ascertain.

"The only difficulty, therefore, is the production of the hydrocellulose. This substance can be obtained from any form of cellulose, but the best for the purpose will be found to be raw cotton in tufts. For effecting the conversion there are three ways: (1) Immersion for several hours in concentrated acids; (2) exposure to the vapors of the hydracids, as hydrochloric or hydrofluoric acid; (3) absorption by a weak acid, and then desiccation. Of these three methods the last-named is undoubtedly the most convenient. Take, then, some fine tufted cotton, and immerse it in a 3 per cent solution of nitric acid; remove it immediately, drain it, and put it in a cloth and wring it well; then pull it out and leave it to dry. If you are pressed for time, you may dry it on a stove at a temperature of 40° to 50°; a few hours will in that case suffice to render the cotton quite friable, and its transformation into hydrocellulose will be complete. But care must be taken not to raise the temperature above the point indicated, or the substance will turn yellow and decompose. When, however, time is no object, let the cotton be well pulled asunder, and then be allowed to dry slowly on a plate in the laboratory or studio at a temperature of from 15° to 20°. By this, the more preferable method, the cotton will, in a few weeks, be converted into hydrocellulose, which, though perfectly friable, will preserve sufficiently its fibrous condition to be easily acted on by the acids that are to nitrify it.

Back Numbers and Volumes.

Subscribers to the SCIENTIFIC AMERICAN will be entered on our books to commence at the date the order is received, but those desiring the back numbers to the commencement of the year will be supplied on their signifying a wish to have them. Last year's volumes may be had in sheets by mail at regular subscription price, namely, $3.20.

THE series of illustrated articles on "American Industries," which was commenced in this journal about one year ago, has proved so acceptable to our readers that it is our purpose to continue the publication of manufacturing establishments until every important industry of the country has been illustrated and described in these columns.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue. ☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

For the best Stave, Barrel, Keg, and Hogshead Machinery address H. A. Crossley, Cleveland, Ohio.

Machinist's Tools, Steam Pumps, Centrifugal Pumps, Iron and Woodworking Machinery, Engines, Boilers, and Supplies. O. L. Packard, 52 W. Water street, Milwaukee, Wis.

Wanted—Machine Shop to make Engines in quantities, by contract. E. E. Roberts, 107 Liberty St., N. Y.

Solid and Opening Die Bolt Cutters, Screw Plates, and Taps. The Pratt & Whitney Co., Hartford, Conn.

The genuine Asbestos Roofing is the only reliable substitute for tin; it costs only about one half as much, is fully as durable, is fireproof, and can be easily applied by any one. H. W. Johns Manufacturing Co., 87 Maiden Lane, New York, are sole manufacturers.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

For Sale.—Two Windmill Patents, and set of patterns for same. Note letter. F. C. Maxwell, Columbus, O.

For Sale.—Flexible Lumber Patent for Cylinder Laggings. Geo. C. Satchell, Norwich, Conn.

Wanted.—Second-hand Magic Lantern Slides. Give quantity, quality, size, and price. Address Lantern, Baltimore, Md.

Wanted. Particulars and Proposition for Ice Machine. Box 220 Charleston, Kanawha, Co., W. Va.

For Sale Cheap.—The entire patent for best Egg Beater ever put on the market. See illustration in SCIENTIFIC AMERICAN of February 21, 1880. Address H. C. Mann, Frankford, Pa.

Wanted—Circulars, with prices, from Manufacturers of Small Drop Hammers, that will strike one or more blows and then stop, and always up, with adjustment for heft of blow, and that will give from one to two hundred blows a minute. Must be open on one side for large work. Address Willcox, Treadway & Co., Cleveland, O.

Steam Engines, Boilers, Portable Railroad Sugar Mills. Atlantic Steam Engine Works, Brooklyn, N. Y.

For Sale.—Four Boilers, 100 horse power each, return drop flue; A 1 condition; $1,500 each. 1 Berryman Heater, 42 x 96; A 1 condition; $400. D. L. Einstein, 16 White St., New York.

For Iron Gas Pipe, see adv. on inside page.

Vertical and Steam Yacht Engines. T. B. Pemberton, 256 Water St., New York.

Wanted—A competent Die Sinker. Steady employment. Address B. P., Box 772, New York.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Wanted.—An Oil Mill of the most improved pattern, for the manufacture of cotton seed oil from the seed of the Sea Island cotton. State price and terms. Address Spirit of the Times, Jasper, Fla.

Wanted.—A few sober, industrious Machinists and Moulders. Address H. B. Smith Machine Co., Smithville, Burl. Co., N. J.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 126.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 125.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 45.

Nickel Plating. Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 110.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $30. Attached to any instrument. T. Shaw, 915 Ridge Ave., Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars send for pamphlet.

Hydraulic Jacks and Presses. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Steam Engine for sale very low. See advertisement on another page.

Portable Forges, $10. Roberts, 107 Liberty St., N. Y.

Mica in sheet and scrap for sale in quantity to suit. Parties using Mica in any form please send for samples. Atlantic Land and Mining Co., Box 2702, Leadville, Col.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 141.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 94.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Silent Injector, Blower, and Exhauster. See adv. p. 141.

The Paragon School Desk and Garretson's Extension Table Slide manufactured by Buffalo Hardware Co.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 142.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Power Hammers. P. S. Justice, Philadelphia, Pa. p. 77.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 733 Broadway, N. Y.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Millstone Dressing Machine. See adv., page 142.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 126.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

New Economizer Portable Engine. See illus. adv. p. 108.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 141. Totten & Co., Pittsburg.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Engines repaired without loss of time. L. B. Flanders Machine Works, Philadelphia, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) P. G. asks: 1. With what substance are the porous cups of a Leclanche battery filled? A. With granular black oxide of manganese. Some makers fill them with equal parts of black oxide of manganese and retort carbon. 2. How is hard rubber polished? A. It is first filed or turned into shape, then smoothed with emery paper, then with powdered pumice stone applied with a felt wheel or felt rubber. The final polish is given by fine whiting and water applied with a brush.

(2) L. C. C. asks: How many horse power do you think would be required to propel a yacht at a speed of ten miles per hour, length 25 feet, breadth 6 feet, built after the "Sharpie" model, total weight of vessel and cargo 4,000 lb.? A. From six to eight horse power.

(3) M. F. R. writes: I think of building a small boat, and would like you to tell me what size single engine and boiler I should get. Length of boat 32 feet, 7 feet beam. It is not to be a flat bottom, and I want to put on a stern wheel, as our river will not admit of a screw. What size wheel shall I use, and how wide should the paddles be? A. About 7 inch cylinder and 10 inches stroke; wheel 7 feet diameter and 9 inch bucket; vertical tubular boiler 34 inches diameter and 6 feet in height.

(4) A. L. K. writes: We have here in this city three telephone lines running parallel for four or five hundred feet. Two of them use the Bell telephone, and one the Edison. Now, when they are using the Edison we can hear every word said by listening at either of the other lines, and they are not within two feet or more of each other; that is, the lines do not run any nearer than that. Can you give the reason? A. The effect noted by you is due to electrical induction. An intermittent or vibratory electric current passing over a line will induce a current in a parallel line, even if the two wires be several feet apart. This phenomenon is beautifully illustrated by Hughes' induction balance and sonometer, fully described in SUPPLEMENT, No. 196.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

H. J. F.—1. Quartz, decomposed hornblende and feldspar. 2. Coccolite in quartz. 3. Mispickel and mica slate. 2 and 3 may carry a small amount of silver.—J. C. D.—It is metallic antimony, worth about 18 cents per lb. in large quantities.

COMMUNICATIONS RECEIVED.

New Copying Process. By E. P. T.
On Sun Spots. By E. E. B.
Another New Copying Process. By E. P. T.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 3, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Addressing machine, W. H. Woodruff, Jr. 224,064
Air compressor, W. R. Eckart 224,081
Animal trap, H. Shalenbarger 224,295
Arrow rest for bows, N. R. Streeter 224,134
Audiphone, T. W. Graydon 224,177
Axle box, car, W. G. Mitchell 224,209
Axle lubricator, car, S. J. & G. J. Shimer 224,047
Axle, vehicle, J. Conniff 224,077
Bag tie, M. Y. Hall 224,190
Ball trap, T. M. Smith 224,040
Barrel lifter, W. Brown 224,157
Bed bottom frames, etc., corner fastening for connecting, W. F. Moody 224,028
Beer, manufacture of, G. C. Holdner 224,196
Berth, oscillating ship's, T. O. L. Schrader 224,232
Binder, temporary, J. T. Foster 224,164
Bird cage, F. W. Flato 224,103
Blind, inside, J. M. Abbott 223,973
Blotter, J. A. Austin 224,124
Boot tree, G. W. Badger 224,067
Bottle stopper, J. J. Allison 224,122
Bow, J. B. Robinson 224,049
Brake pipe coupling and valve, C. G. Welch 224,216
Bucket, sail, S. W. Jones 224,018
Buckle, suspender, G. R. Kelsey 224,100
Building, fireproof, J. Gilbert 224,173
Burglar alarm, J. Israel 224,017
Burglar alarm, electric, W. L. Voelker 224,060
Butter, etc., cover and cooler for, W. E. Barrows 224,126
Button and stud, N. F. Mathewson 224,099
Button, detachable, J. P. Carpenter 224,144
Button, separable, J. P. Carpenter 224,143
Buttons, etc., from fibrous material and powdered hoof, manufacturing, W. F. Niles 224,006
Cake machine, D. M. Holmes (r) 9,052
Car coupling, Bayliff & Harrod (r) 9,068
Car coupling, F. A. Lewis 224,204
Car coupling, G. H. Wilson 224,262
Car heater, M. Limpert 224,194
Car ventilator, C. W. Thomas 224,248
Carbonates and bicarbonates, manufacture of, A. Stearns 224,246
Carpet pads, machinery for making, D. M. Small 224,058
Carpet sweeper, E. K. Breckenridge 224,093
Caster, furniture, J. Toler 224,363
Casting metals, apparatus for, Taylor & Wailes 224,143
Catarrh, compound for nasal, G. L. Gorsline 224,084
Chandelier, F. Rhind 224,226
Chimney top and ventilator, G. W. & L. Demond 224,134
Chock, gaff-topsail sheet, W. Metzler 224,087
Chuck, scroll, D. E. Whiton 224,119
Churn, H. Smelser 224,113
Churn, H. Van De Water 224,059
Cigar packing press, F. C. Miller 224,208
Clamp for carrying school books, H. Tollner 224,263
Clay into tiles, etc., machine for pressing and moulding, I. Hagsland 224,015
Clock, electro-magnetic, D. F. Sweet 224,243
Clothes hook, J. W. Drew 224,088
Clothes wringer, Lawrence & Kerr 224,019
Coach or harness pad, Cahoone & Teas 223,904
Coffee roaster, J. H. Chamberlin 224,060
Compass, solar, F. Moore 224,101
Cooking device, R. B. Wakefield 224,222
Corset, M. Cohn 224,026
Cotton opener feed indicator, J. Hill 224,285
Cotton picker, J. B. Parker 224,321
Crushing, grinding, and amalgamating machine, L. Haight 224,097
Cultivator, Blodgett & Smith 223,992
Cultivator, C. D. Carter 224,074
Cultivator, S. G. Pomeroy 224,039
Cultivator, E. & E. C. Slosson 224,111
Cultivator, sulky, H. R. Burdge 224,130
Cymbal drum, T. W. McKeever 224,204
Dental plugger, G. B. Snow 224,050
Desk and work box, comb'd writing, A. Wernicke 224,257
Desk, school, J. Glendenning 224,174
Door check, N. Kidney 224,020
Door hanger, T. H. Bottomley 223,995
Dovetailing machine, G. W. Parker 224,100
Draught or lug link, spring, J. F. Miller 224,220
Drawer front, R. A. Armstrong 224,066
Dredging machine, Maguire & Alexander 224,107
Egg beater, B. A. Ulmer 224,117
Emery cloth, F. Copeland 224,079
Extension table, W. Fay 224,007
Faucet attachment and tank, J. A. Vallentine 224,053
Faucet, measuring, W. H. Sack 224,105
Feeding trough, J. W. McNeal 224,206
File for packages of letters, F. W. Sanguinet 224,270
Fire extinguisher, H. Bohle 223,984
Fire extinguisher, chemical, J. A. Shepard 224,230
Fireplace, J. H. Beard 224,129
Gate, J. C. Mendenhall 224,100
Gearing for changing the speed of rotating shafts, B. F. Shaw 224,045
Gearing to shafting, key for attaching, T. G. Morse 224,103
Gimlets, die for forming double twist, A. H. & J. S. Demes 224,156
Glass or chinaware utensils, connecting parts of, J. Story 224,130
Grain drier, J. L. Norton 224,213
Grain drill, R. Kuhns (r) 9,066
Grain separator, J. A. Olson 224,220
Grinding mill balancing device, H. Smith 224,236
Hammer, horseshoe, H. N. Mallery 224,028
Hammock support, J. Bisson 224,078
Hatchway doors, operating, G. W. Moulden 224,215
Heel leveling and surfacing machine, McKay & Fairfield 224,025
Heel piles, machine for forming, C. W. Glidden 224,012
Heel slicing machine, C. W. Glidden 224,011
Hitching post, S. M. Furman 224,083
Hop press, H. W. Mahan 224,097
Horseshoe nails, machine for finishing, H. A. Wills 224,062
Hydrant, J. Ward 224,061
Ice machines, etc., producing of cold in, Du Motay & Rossi 224,246
Incubator, E. A. Renwick 224,224
Inkstand, J. H. Wilcox 224,261
Insect trap, A. N. Lovelace 224,100
Jewelry charm, G. B. Whitney 224,260
Jewelry manufacture, device for bonding wire for, A. M. English 224,164
Journal and bearing, car, J. H. McLean 224,206
Knitting machine, B. F. Shaw 224,046
Ladder, step, M. N. Lovell 224,193
Lantern, E. B. Requa 224,225
Lantern, hand signal, W. Armstrong 224,065
Last, L. W. Sherey 224,234
Latch, A. B. Prouty 224,040
Lathes, tool post for turning, G. S. Fales 224,006
Leather, machinery for assorting pieces of, H. P. Fairfield 224,005
Leveling instruments, tripod head for, L. B. Denison 224,155
Lifting jack, J. S. Kirkwood (r) 9,062
Lighting device, J. J. Lawlar 224,191
Liquid cooler, C. A. Haus 224,202
Loom, G. Crompton 223,994
Loom reed, E. Adamson 223,974
Loom temple, N. I. Allen 223,976
Lounges, reversible back for, R. L. Fairbank 224,092
Measure, grain, H. M. Dygert 224,158
Metal worker's tool, S. G. Wilcox (r) 9,064
Millstone dressing machine, D. B. Greenwald 224,086
Moulding and perforating plastic substances, apparatus for, A. Stearns 224,240
Moss, treating and curing Spanish, H. T. Cummings 224,080
Motion transmitter, rotary, C. L. French 224,169
Motion, transmitting rotary, C. L. French 224,168
Music rest for pianofortes, E. A. G. Roulstone 224,042
Musical chart, Cleave & Gordon 223,991
Musical instruments, automatic key board attachment for, W. J. Crane 224,153
Nickel, electro-deposition of, J. Yates 224,263
Nursery chair, convertible, H. B. Hale 224,141
Oil, apparatus for extracting, S. G. Clark 224,075
Oil cake, envelope for the manufacture of, Brittain & King 224,135
Oil condensing and separating apparatus, coal, J. H. & W. F. Nicolai 224,037
Oiler and oil bottle, combined, H. Ritter 224,041
Oscillating engine, J. F. Kingsley 224,086
Oven slide, L. A. Weiner 224,256
Overalls, J. B. Glover 224,175
Paper box, wood lined, J. W. Sprowles 224,232
Paper cabinet, E. A. Gilson 224,010
Paper folding machine, W. Spalckhaver 224,054
Paper pulp from cane leaves, making, C. Fulton 224,170
Paper pulp, machinery for grinding wood for, W. A. Doane 224,082
Pen, stylographic fountain, Fisher & Downes 224,162
Pianoforte action, H. Kotten 224,091
Pianoforte action frame, upright, C. S. Fischer 224,008
Pipe, collapsible ball for welding, T. J. Bray 223,986
Piston head, J. West 224,258
Pitcher, molasses, B. F. Culver 224,080
Pitman, A. H. Merriman 224,207
Platting machine, M. A. Maybee 224,211
Planter and fertilizer, check row corn, H. F. Graetzel 224,176
Planter and fertilizer distributer, combined hand corn, D. A. Swanson 224,242
Planter, corn, T. B. McConaughey 224,030
Planter, sod, S. Neill 224,032
Plow, J. B. Bruce 223,992
Plow attachment, L. Price 224,223
Plow, reversible, C. C. Brooks 224,136
Plow, rotary gang, C. H. Foster 224,009
Plow, sulky, W. A. James 224,199
Plow, sulky, A. Lindgren 224,195
Plow, sulky, B. F. Litzenberg 224,095
Plow, sulky, J. B. Neff 224,034, 224,035
Poke, animal, J. T. Camp 224,140
Pole, carriage, S. A. Galbraith 224,171
Polishing machine, A. Newhall 224,214
Polishing small articles, machine for, G. G. Guild 224,186
Post office box door, W. H. Camp 224,142
Potato digger, L. A. Aspinwall 224,123
Pressure regulator, fluid, Kipp, Jr., & Murphy 224,190
Printing machine, plate, A. M. Bogart 224,131
Printing machine, rotary, G. Bisinger 223,981
Propeller, vibrating, H. K. Shanck 224,228
Pump, R. T. Ligon 224,103
Pump, vacuum, W. H. Guild, Jr. 224,179
Radiator, steam, G. W. Blake 224,131
Radiator, steam, Tudor & Evans 224,056
Rag engine, bed plate for paper, G. A. Corser 224,079
Railway switch, C. Dooherdey 224,152
Railway switch, C. W. Tarbox 224,054
Rattan, machine for working, A. Mottis 224,212
Refrigerator, J. H. Porcupile 224,222
Refrigerator building, H. Smith, Jr. 224,048
Rocking chair, adjustable, M. F. Bell 224,130
Rocking chair, folding, C. O. Collignon 223,996
Roller gates, apparatus for operating, H. Allen 224,121
Rope twisting machine, C. Van Houten 224,054
Rotary engine, I. J. Baker 223,978
Rotary engine, F. H. Cathcart 224,146
Saddle tree, harness, E. B. Cahoone 223,990
Saddle tree, harness, Cahoone & Teas 223,989
Salt, manufacturing fine, T. Higgin 224,013
Salt wells, cleaning, J. Mason 224,098
Salve, J. Myers 224,031
Saw mill dog, T. Craney 223,997
Scaffold, portable window, J. Skidmore 224,110
Scales, balance, G. A. Pfeifer 224,038
Seal lock, Thomas & Kelsey 224,113

DESIGNS.

TRADE MARKS.

English Patents Issued to Americans.

From January 30 to February 3, inclusive.

Clothes frame, F. M. Earle, Utica, N. Y.
Explosive compound, M. Tschirner, San Francisco, Cal.
Furnace, puddling, W. Stubblebine, Bethlehem, Pa.
Feather dusters, L. M. Hibbard, Geneva Lake, Wis.
Hobbyhorse, P. Marque, Cincinnati, O.
Hydraulic engine, J. Morton, Philadelphia, Pa.
Lock, registering, H. L. Russell, Bloomington, Ill.
Metals, extraction of, A. I. Tichener, San Francisco, Cal.
Plaiting machines, W. Duffus, Syracuse, N. Y.
Refrigerators, D. W. Sanford et al., St. Louis, Mo.
Sewing machines, N. A. Baldwin, Milford, Conn.
Telephones, E. Marx et al., Ilion, N. Y.
Telephone switches, F. A. Watson, Everett, Mass.

Advertisements.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 11. [NEW SERIES.] | NEW YORK, MARCH 13, 1880. | [$3.20 per Annum. [POSTAGE PREPAID.]

AMERICAN INDUSTRIES, No. 34.

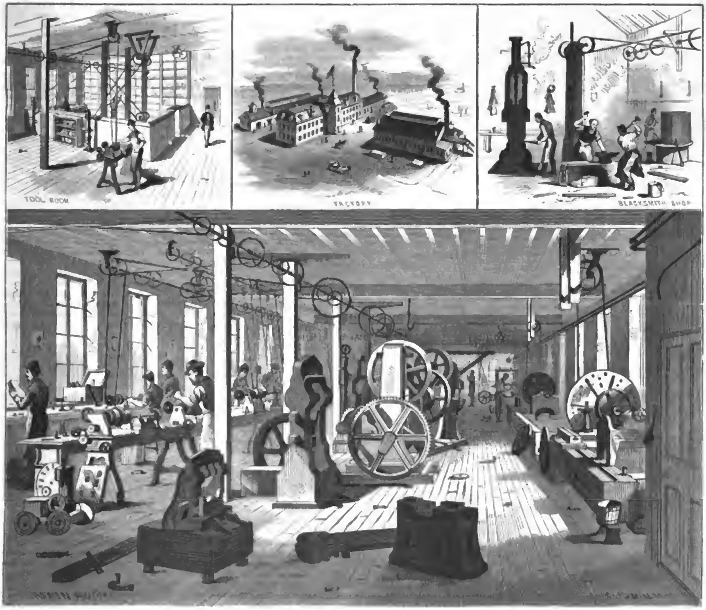
THE MANUFACTURE OF PUNCHING AND DRAWING PRESSES, DROP HAMMERS, DIES, ETC.

The making of machines with which to make other machines has been a peculiarly distinctive idea with American inventors and mechanics. Here this conception practically had its origin, and the extent to which it has been developed within the past twenty years has probably done more to place our manufacturing industries in the front rank, as compared with those of the older countries of the world, than any other one cause. We use machinery vastly more than it is used anywhere else, and in thousands of operations where, even in the best machine shops and factories of France, Belgium, and England, hand labor is employed to do the same work; any invention or improved process of manufacture, therefore, which aids in lowering the cost of machinery, is a direct gain to every branch of manufacturing industry.

Probably no department in metal working has shown a more steady growth, and a development fraught with greater or more general advantages, than the manufacture of power punching and drawing presses, with the drop hammer, for forging, by means of steel dies, a branch of business which affords the subject of the first page illustrations of this paper. The establishment we here represent is that of the Stiles & Parker Press Company, of Middletown, Conn., whose presses have for many years been widely known in every manufacturing section of the United States, as well as in many foreign countries. The company own more than twenty-five patents on presses and drops, several of which were obtained by Mr. Stiles, for inventions he has made since he commenced their manufacture. In 1863 he invented a particularly important feature of the press, the eccentric adjustment, which added greatly to the efficiency of the power and other presses then in use. This invention he patented in 1864, and by its use the punch may be adjusted to the die to the hundredth part of an inch. Before this the punch was adjusted with thin plates of metal above and below the box, but this plan was superseded by the eccentric adjustment. After this patent had been issued, the idea was adopted by Parker Brothers, of Meriden, Conn., who were also manufacturers of presses, and three years of litigation followed, from 1868 to 1871, when the matter was terminated by the consolidation of the interests of both parties to the suit in the Stiles & Parker Company, in which Mr. N. C. Stiles has the controlling interest. By this union, and by subsequent purchase, nearly all the valuable patents affecting the manufacture of presses and drop hammers have come into the possession of the present company.

The use that could be made of the power press twenty-five years ago was exceedingly circumscribed, in comparison with what may be effected thereby to-day. The common method of stopping the press then was to run off the belt, and it was impossible to work it quickly because the punch might not stop at the proper time, and so spoil the job. This difficulty was obviated by the automatic stop, which was patented in 1855, and consisted of "a contrivance for disconnecting the wheel and the shaft at a certain point, after one revolution." When this improvement had been introduced the number of uses to which presses could be applied was greatly enlarged, and their efficiency was largely increased. A great drawback for a long time, however, was in the difficulty which was found in accurately adjusting the punch; the bed was sometimes blocked up, but this was likely to interfere with the accuracy and solidity necessary in all work; screw and nut arrangements were used in light work, but these threw too much strain on the threads of the screws to be generally efficient; the pitman was sometimes made in two parts, between which plates of metal were secured by bolts, but in this way there was danger of getting the bearings out of line. All of these difficulties were, however, obviated by the eccentric adjustment of Mr. Stiles, with which could be obtained: (1) extreme accuracy; (2) the bearings were not thrown out of line by its

[Continued on page 165.]



THE MANUFACTURE OF PUNCHING AND DRAWING PRESSES.—WORKS OF STILES & PARKER, MIDDLETOWN, CONN.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, MARCH 13, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 219.
For the Week ending March 13, 1880.

Price 10 cents. For sale by all newsdealers.

WHO SHALL HOLD THE SURPLUS?

A large New York drygoods house recently made a calculation as to what effect it would have on their year's trade should every one of their customers purchase, for the year 1880, only $100 worth more of goods than he had bought in 1879; they afterward enlarged the scope of their inquiry and estimated the increased volume of trade should every retail dealer in the country buy $100 worth more than he had bought last year. It is hardly necessary to say that the aggregate amount reached by the figures made on this basis was something which at first appeared to them almost fabulous, representing, as it did, sufficient increase in the demand for goods to make it certain that, with only this seemingly moderate enlargement of trade, every loom and spindle in the country would be pushed to the utmost to supply what would be wanted.

It is very common for men everywhere to base their calculations as to the probable increase in the demand for manufactured goods this year entirely upon the greater ability of consumers to purchase. This enlarged purchasing power of the final customers has been very conspicuously manifested in the agricultural sections, on account of the bounteous crops, coming at a time when there was urgent need and a ready market for them; and in manufacturing communities the increased demand follows because the agriculturists are better off, even more than from the fact that we are now liberal exporters of manufactured articles. But, although these are the true causes of a comparatively permanent improvement in trade, he who would look to them solely for an explanation of the great activity which we have seen in most branches of business during the past six months, and which it now appears more than probable will continue for some time to come, would leave out one of the most important of the factors necessary to a correct judgment. This factor is to be found in the one word, "confidence," which is now general, as against fear and distrust, which everywhere prevailed from the early fall of 1873 to the summer of 1879. How much this means it requires but little to show, so as to bring home the truth to every man's comprehension, although it would be impossible to fully measure the extent of the change wrought.

From 1873 up to last summer, no matter how cheaply a dealer or an investor might have bought goods, or how great a "bargain" was obtained, each subsequent purchaser could buy at even lower figures. Prices were on an inclined scale throughout; it seemed as though they would never touch bottom. The natural effect of this was that the jobbers and retailers, the army of middlemen who stand between the producer and the consumer, were compelled, as a matter of self-protection, to hold steadily diminishing stocks of goods. They bought only as they actually needed supplies, and then purchased as sparingly as possible, forcing back upon the manufacturer, or into "first hands," all the surplus in the country which the then limited requirements of consumers did not seem to be making an immediate demand for.

Now all this is changed, and, over and above the quantities of goods which every dealer feels sure he will be able to find ready sale for, all are desirous of having something in stock, or, in other words, to help the manufacturers and the first owners "hold the surplus." The reason is obvious; whereas, heretofore, prices steadily declined, and the demand was always sluggish, the tendency now seems to be invariably upward, the call always active, and most kinds of merchandise, with the present comparatively low rates of interest, offer exceeding desirable channels for the investment of surplus means.

This confidence of dealers, based on the guarantees they have in hand of the ability of consumers to purchase liberally, may, without anything like enthusiasm, be relied upon to maintain the energy and give lengthened vitality to the period of business enterprise upon which we seem to have so auspiciously entered. And in no one of the general divisions of business activity does this renewed life seem to run so high or hold forth such large promise as in those connected with metal working. Iron and steel especially, in all the various forms through which they are made to serve the purposes of man, are now so eagerly sought for, notwithstanding prices have advanced 100 per cent, that our furnaces and foundries and machine shops can hardly begin to satisfy the demand. Railroad building is being pushed with great energy, calling not only for vast quantities of rails, but the locomotives and cars for equipment; factories of all kinds are enlarging their production, and need new machinery; agricultural implements are in greater demand than ever before; the thousands of ingenious devices which the modern residence calls for from the dealer in builders' hardware cannot be supplied fast enough to meet the wants of those who now find themselves able to build; and, above all this, the middleman now seeks to hold an ample supply of each kind of goods as much as he dreaded having a "surplus" before.

REGULATION OF SHIFTING RIVER CHANNELS.

The shifting character of the channels of the Missouri and other Western rivers is well known. With strong currents flowing through beds of light alluvium, the erosion of the banks is constant and frequently very rapid. Under this action, where the circumstances are favorable, bends are formed, not unfrequently taking the shape of loops, with narrow strips of land separating two portions of the river that are several miles apart when measured along the channel. When these narrow strips are washed through, cut-offs take place, which shorten the course of the river, change its slope, increase its velocity, and otherwise disturb its regimen for many miles both above and below. Increased erosion takes place, navigation is impaired, interests along the banks are jeopardized, a different course is given to the river, new bends are formed, and the foundation laid for a repetition of the same series of events at some future day.

The most destructive erosions take place during the falling stages of the water. The foot of the bank is first attacked, and when the material, usually sand, is washed away, the upper portion, being unsupported, tumbles into the water. This eroded material is carried down either in suspension or rolled along the bed of the river. As the current from time to time is checked either by a diminution of the slope or by meeting some obstacle in its course, the material *in transitu* is deposited and for a time at least brought to rest.

These depositions, in their turn, change the course of the river, and cause its current to impinge against the bank in some new locality further down. Thus the operation goes on day after day and year after year.

As the commerce of these rivers increases in magnitude and value, and the lands along their valleys are converted into valuable farms or the sites of towns and cities, it becomes a matter of great importance to prevent such erratic washings of the shores and changes of the channels. To keep the rivers within regular bounds the yielding banks have to be protected, the velocity of the current diminished in certain places, and the channel held in place by building up or solidifying its sides.

The different means employed in this sort of work are described by Captain Hanbury, of the Engineer Corps, in a recent report on the condition of the Missouri river near Omaha. For causing deposits to take place, and for deflecting the current in localities that are to be built out, floating brush obstructions have been applied with marked success. The most successful of these is the floating brush dike, made by taking saplings from 20 to 30 feet long and from 4 to 6 or 8 inches in diameter, and nailing, or fastening to them with wire, scraggy brush of any kind obtainable in the locality. This forms what is known as the "weed." Instead of the saplings rope may be used to hold the brush. To one end of this "weed" is attached an anchor of sufficient weight to hold it in position against the current; to the other a buoy to hold up the downstream end and prevent it from going to the bottom under the pressure of the current against it. These "weeds" are placed from 10 to 20 feet apart, thus forming the floating dike.

Their action is to check the current gradually without producing that scouring effect to which the solid dike gives rise. This done, a portion of the material that is rolling along the bottom or being carried down in suspension is deposited, and causes a rise in the bed of the river, which changes its channel to the direction desired. The rapidity with which these deposits take place is truly wonderful. One season is often sufficient to raise the river bed up to the limits of ordinary high water.

Another form of obstruction that has been tried with success is the willow curtain. This, as its name indicates, is made of willows about an inch in diameter or larger, fastened parallel with each other, and from 6 to 8 inches apart, by means of wire. The curtains can be made of any desired length and width. They are anchored in position by weights attached at intervals along the lower edge and held in an upright or inclined position in the water by floats made fast to the upper edge. Their action is similar to that of the "weeds."

Another form that has been experimented with and which bids fair to give good results, is a screen made totally of wire something after the fashion of a seine. It is anchored and buoyed like the willow curtain. The rootlets and small vegetable fibers that float in large quantities in the water accumulate upon the wires, and form obstructions sufficient to check the velocity of the current.

For resisting the impact of the current and preventing the erosion of the banks, a variety of devices have been tried with more or less success. Among the most satisfactory of these are the woven brush revetment, the continuous mat, or brush blanket, made of brush, sewed together with wire, and the willow screen, made as above described, for the willow curtain, excepting that the willows, instead of being placed some inches apart, are as nearly as possible in juxtaposition. The manner of using all of these devices is the same. The bank to be protected should first be graded to a slope of about 2 upon 3 or less, an operation that can be very cheaply performed by the use of hydraulic force pumps, after which the revetting should be put on so as to extend from the ordinary high water limit down the bank and out along the river bed sufficiently far to protect the slope should any unusual scour take place. The total width is usually in the neighborhood of 100 feet. To sink that portion which is under the water, a small quantity of rock is sometimes necessary, but usually the current itself and the sediment that collects on the brush will suffice for this. The effect of this revetment is to thoroughly protect the bank over which it is placed, and to cause a deposit of sediment over itself that crowds the current away from the bank toward the middle of the stream.

In proportion to the results obtained on the Missouri, these devices are the cheapest that have yet been tried for the improvement of sediment-bearing rivers. The brush dikes cost about $1 a running foot; the revetment of the banks from $2.25 to $2.50 a foot.

THE DRIVE WELL IN NEW YORK CITY.

It is only within a comparatively recent period that manufacturers and others using large amounts of water in their business have learned how costly that fluid is in some of our principal cities, and especially in New York. According to the city charter, the large users of water from the city mains, such as hotels, factories, breweries, and in fact business establishments of every kind, are now compelled to put in water meters, so that the quantity they consume may be accurately determined, and the amount they must pay be regulated thereby. The law requiring this remained for a long time almost a dead letter, on account of differences of opinion as to what form of water meter was the best, but during the last year or two the Commissioner of Public Works has been energetically pushing forward the introduction of a meter chosen by that department, and therewith has come a great change in the size of almost everybody's bills. Heretofore the amount of the water tax for different establishments had been fixed upon estimates of the quantity required, but now the water used must be paid for according to the registers of the water meters, which make the cost in some cases a hundred fold greater than it was under the old system. There are many instances where this charge upon manufacturers has amounted to as much as $5,000 a year, and in other cases the tax for the water used, measured by the meters, would have been fully equal to $15,000 to $20,000 a year.

On many grounds it is a great advantage to manufacturers of different kinds to be located in large cities, and the industrial interests of New York City, aside from those directly connected with its imports and exports, have been principally instrumental in drawing together the large populations now dwelling on Manhattan Island and the immediate suburbs on the North and East Rivers. Here the workmen can be found in sufficient numbers, in any and all trades, to give the employer an opportunity to select his hands, or to put on extra help at any time; here also we have the first market for many kinds of raw material and the largest market in the country for all kinds, both domestic and foreign, as well as the best point for the sale of the goods. Against these advantages, however, city producers have to pay much higher rents and heavier taxes than those located in rural districts, and, before the enforcement of this enormous water tax was effected, the competition with manufacturers in other places was in many cases a very close one. It would seem that the city should be more liberal in such matters, with a view to encouraging the growth of diversified manufacturing industries here, but the Department of Public Works find that the consumption of water is increasing so rapidly that it will soon, at the present rate, overtake the possible supply from the reservoirs now built, to enlarge which will entail heavy expense. It is also true that where there is not a strict accountability, large quantities of water are allowed to run to waste. From both these considerations the city authorities appear to be determined to adhere to their present scale of charges, a course which is leading many to adopt the driven well as a source of water supply. Its use has already become extensive in this city, and not only here, but all over the country, this mode of obtaining water is now being resorted to more than ever before.

With the different patents covering this method of water supply we do not now propose to speak. There are 150 patents on what is called the "point," or the bottom piece at the lower end of the tubing, into which the water first enters from the ground; as the result of the work of so many minds it would naturally be expected that something tolerably near perfection had been obtained, and it seems as though the one now generally being put down in New York meets all the requirements for such work. It is of heavy galvanized iron, about two and a half feet long, with small holes at regular distances on several sides, these holes being in hollows of the iron made by a sort of ribbed work, and around the whole of this part of the point is a fine brass sieve or netting. The room for the water to flow in here at the starting point, at the bottom of the well, is many times the capacity of the tube above, and the openings are so well protected that it must be very difficult, and is said to be impossible, for anything to get in the pipes which would prevent the regular flow of the water. Tubes with two inches inside diameter are very largely used, the tubes being generally made of wrought iron. The amount of water which one well will afford varies widely, as high as forty gallons per minute having been obtained in some places, and as low as ten gallons a minute in other localities. There is an abundance of water to be had over a large section of Manhattan Island at a distance of from thirty to eighty feet below the surface. The quality of the water obtained varies in different places, but it is generally only necessary to go low enough to get clear, pure water, for, by this system of making a well, the tube may be driven entirely through one stratum of earth furnishing an inferior quality of water, until a different stratum is reached which will give water as pure as desired, when the supply is drawn only from the latter source. As this water, however, has the general properties of nearly all well water, it is not always the best kind to use in steam boilers, and where it is so used, a chemical composition should be added to prevent the injurious effects which have been experienced from its continued use for this purpose.

The cost of these wells, as they are covered by patents, is fixed according to the supply of water required, on the principle that the wells shall be put down for the amount which one year's supply of water would cost from the city i.e., the city's charges are based on the general rate of two cents for one hundred gallons—then for a manufacturer requiring 6,000 gallons a day, the cost of Croton water, counting 300 working days in a year, would amount to $360, and for this sum, or a little less than that proportionately where the supply needed is very large, one or more wells are put down sufficient to give the required quantity. So far there have been but few instances of any trouble in obtaining a regular supply after the wells have once been properly put down, and many wells and gangs of wells have now been in operation eight years, with no apparent change in the flow or the quality of the water.

FERDINAND DE LESSEPS AND THE CHAGRES CANAL.

The Viscount Ferdinand de Lesseps, with his family and staff of engineers, arrived in this city Feb. 25, from Panama, where he had been to examine the route of the proposed Chagres Canal.

Born in Versailles, France, Nov. 19, 1805, M. de Lesseps early entered the diplomatic service of his country, continuing therein some forty years. In 1854, he went to Egypt on the invitation of the Viceroy, Said Pasha, to examine the project for a ship canal across the Isthmus of Suez, and two years later he published a memorial giving full details of the enterprise. A stock company for the construction of the canal was formed, and M. de Lesseps gave himself up entirely to the prosecution of the great undertaking. The work was begun in 1859, and completed in 1869. This great achievement, conceived and carried out in spite of gigantic physical, financial, and political difficulties and discouragements, gave M. de Lesseps undisputed rank as the first engineer of the age.

Since the completion of the Suez Canal M. de Lesseps has suggested or has been consulted with regard to several great geographical and speculative enterprises—among them the conversion of a large area of the Sahara desert into an inland sea; the cutting of a ship canal through the Isthmus of Corinth, which is now being excavated; and the laying out of an elaborate scheme of Russian railways connecting the south and east of Europe with India. All these projects, however, are of comparatively small importance beside that of severing the Isthmus of Panama by means of a salt water ship canal at sea level.

With the history of this enterprise, since the Canal Congress in Paris last spring, the readers of the SCIENTIFIC AMERICAN are already familiar. M. de Lesseps says that as early as 1869 he was convinced that a sea-level canal without locks was the only one practically possible for the Isthmus; and at a public meeting in Paris, in 1870, he confidently asserted that opinion. This, however, it is proper to remember, was purely a matter of theory, for at that time there had been no careful survey of a route for a canal without locks, and accurate estimates of the practicability or probable cost of such a work were out of the question.

Having gone to the Isthmus determined to demonstrate the wisdom of his choice, M. de Lesseps has naturally succeeded in finding confirmation of the justness of his *à priori* belief.

The proposed canal substantially follows the route of the Panama railroad. A tide-lock is to be constructed in the Bay of Panama to control the level of the canal. In the Bay of Limon, on the Atlantic side, it is necessary to construct a breakwater two kilometers long, on account of storms. The cost of the entire work, estimated at 843,000,000 francs, includes the following items: All excavations, dredging, and removal of earth, 570,000,000 francs; dam at Gamboa, 100,000,000 francs; changing the waters of the Chagres, Obispo, and Trinidad, 75,000,000 francs; tide-lock on the Pacific, 12,000,000 francs, and breakwater on the Atlantic coast, 10,000,000 francs. Contingencies are estimated at 76,000,000 francs. The work will take eight years to complete, and it may be commenced before next June. The estimates contemplate the removal of 75,000,000 square meters of rock and soil.

The Gamboa dam will be required to form an artificial lake to receive and regulate the flow of the waters of the three rivers, whose periodical floods furnish the most serious danger to the proposed canal. This dam will be 5,000 feet long and 40 meters high. It will be exceeded in size only by the three great dams at St. Etienne, France, La Gemappe, Belgium, and Alicante, Spain. The last has stood for three hundred years.

At a reception given to M. de Lesseps by the American Society of Civil Engineers, Feb. 26, the distinguished engineer insisted that the proposed Chagres Canal was a much less difficult task than the canal at Suez. The deepest cutting would have to be about the height of the Brooklyn bridge towers. One of the visiting engineers, M. Douzat, said there would be seven miles of deep cutting, averaging 180 feet, of which 160 was rocks. The deepest cutting in other parts of the canal would average 40 to 45 feet. The entire length of the canal is about 45 miles. In answer to the question why a sea-level canal was preferred to one with locks, M. de Lesseps said:

"If the Commission of Engineers which had gone down to Panama had reported in favor of a canal with locks, I should have put on my hat and left the whole project and would have had nothing to do with it. That plan will do for small ships, but when we have vessels now afloat 500 feet long, and others on the stocks 600 feet long, it is impossible to say for what you would have to build locks. Single locks would be slow, and double locks, though quicker, would be very expensive and require constant repairs. At Nicaragua they intended the use of locks, and with the earthquakes which prevail there the repairs would be ruinously expensive, and even at Panama, where earthquakes do not exist, they would be fatal by reason of the loss of time. I would not have anything to do with a locked canal except for little ships. It is not the proper idea for a grand interoceanic canal."

M. de Lesseps is a man of medium height, strongly built, alert in all his movements, erect and elastic in carriage, and seemingly not much over fifty years of age, though really seventy-four. His first days in New York have been devoted to the inspection of the elevated railways, the Brooklyn Bridge, the working of the fire department and the Croton water service.

Loiseau Compressed Fuel.

At the last session of the American Institute of Mining Engineers, held in this city, a paper was read by E. F. Loiseau on "The Successful Manufacture of Pressed Fuel at Port Richmond, Philadelphia." A huge fire in the grate gave evidence of the qualities of this fuel, specimens of which in egg-shaped lumps were examined with interest. The fire was started without the use of kindling wood. The paper explained the process of manufacture, the difficulties encountered, and the measures adopted to obviate them. The elements of this fuel are 91 per cent of coal dust and 9 per cent of pitch, the latter being used to cement the coal dust.

The fuel lasts as long as ordinary anthracite, and does not produce clinkers. Thirteen tons of it are now produced each hour. Reference was made to the difficulty of obtaining a supply of coal dust, as the coal men were not inclined to supply the means of making a fuel to compete with coal. But confidence was expressed that it would soon appear to the advantage of coal men to erect machines for the manufacture of the pressed fuel and make it a leading industry.—*Coal Trade Journal.*

[We have used Mr. Loiseau's pressed fuel in an open grate at our residence, and can add our testimony as to its cleanliness, heat giving and lasting qualities.—ED.]

Land Slide in Fraser River.

A notable disaster occurred in the fore part of February at a place called Maple Ridge, some twelve miles above New Westminster, British Columbia. At that point the Fraser River is a quarter of a mile wide; the south bank about ten feet high, the north bank rising to a bluff of over a hundred feet. Suddenly one afternoon some acres of the highest part of the bluff slid into the river, where it was about fifty feet deep. The breadth of the river was reduced a half, and the rush of earth threw up a wave which flooded for miles the level country opposite the bluff, doing much damage. The river at the place where the land slide occurred presents a strange appearance. Rising from two to ten feet above the surface of the water are trees standing at different angles, some of them as straight as when they stood on the high bank, and others leaning and partly covered with earth. The tract that went into the river was in shape like a half moon. The new bank reveals reddish, light earth for about twelve feet from the top, under which is a stratum of blue clay some twenty feet thick, and all the earth below that, so far as it is visible, is a mixture of coarse gravel and sand. There are large cracks along the bank, extending inland for 150 feet or more. The impression is that still more of the bank will go into the river.

Leading American Industries.

Already more than thirty of our largest manufacturing establishments, illustrating as many different industries, have been published in these columns during the past year. Our artists are now engaged preparing full page engravings, of several other manufacturing works, which will appear in forthcoming issues. It is our purpose to continue the publication of this series of mechanical subjects until every leading industry of the country has been illustrated and described. This feature of the paper has proved very acceptable to our readers and gained for it many new patrons.

New subscribers and others desiring copies of any of the thirty three numbers containing full page illustrations of as many different manufacturing establishments, can be supplied by addressing this office. Price 10 cents a copy by mail.

Snow Eating Unhealthy.

A writer in the *Phrenological Journal* admonishes parents to guard their children from the practice of snow eating, claiming that it has much to do with head colds of many girls and boys, because of the chilling effect of snow upon the palate or thin partition between the mouth and nostrils producing congestion in the fine membrane which lines its upper surface. As this membrane is almost entirely constituted of delicate nerves and blood vessels, inflammation is likely to follow the congestion, and perhaps degenerating into nasal catarrh, an affection so common with persons in our northern latitude.

Back Numbers and Volumes.

Subscribers to the SCIENTIFIC AMERICAN will be entered on our books to commence at the date the order is received; but those desiring the back numbers to the commencement of the year will be supplied on their signifying a wish to have them. Last year's volumes may be had in sheets by mail at regular subscription price, namely, $3.20.

A NEW FRUIT DRIER.

A compact and portable fruit drier, adapted to the wants of farmers and others desiring to produce a good article of dried fruit, is shown in the annexed engraving. The inventor informs us that the device dries apples in a few hours, delivering the fruit white and clean, with all the flavor retained, so that it resembles in all respects the article sold as evaporated fruit.

The case, A, has a number of openings in its front side, for a series of movable drawers for containing the fruit to be dried. The case has a furnace chamber, B, in which is placed a movable sheet iron furnace having a cast iron bottom provided with a handle, *f*. The upper part of the furnace sets loosely on the bottom, and is easily removed to facilitate the discharge of ashes. Charcoal or coke makes the best fuel, but coal from the kitchen fire may be used if the bituminous matter is permitted to burn out first.

The draught of the furnace is regulated by the damper, *m*, and the admission of air to the furnace chamber is controlled by dampers, *j*.

A purifying chamber, C, separated from the furnace chamber by a perforated partition, has shelves or trays containing absorbents by which impurities are removed from the gas and hot air that proceed from the furnace chamber. From the purifying chamber the hot air and gases are drawn upward over and under the several fruit-containing drawers in alternation, and are finally discharged through the flue at the top, carrying with them the moisture from the fruit.

The temperature of the air in the purifying chamber is indicated by the thermometer seen at the right, and the draught may be regulated to give any required temperature.

The drier shown in the engraving is thirty six by twenty inches, and the drawers, ten in number, are about three fourths of an inch deep. Such a drier will contain about two bushels of fruit.

The device may be made small and portable, or it may be adapted to a fixed building.

MUMBRUE'S FRUIT DRIER.

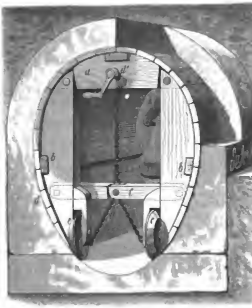
This fruit drier is the invention of Mr. William B. Mumbrue, of Montour, Iowa.

IMPROVED ROLLER GATE.

The annexed engraving represents an improved apparatus for operating roller gates, recently patented by Mr. Henry Allen, of Silverton, Oregon. The invention consists in the application of an endless chain or rope to a double or single roller gate, the rope being provided with handles and conveniently arranged so that the gate may be opened by pulling the rope in one direction, and closed by pulling it in the other direction.

The engraving shows the application of this device to a double rolling gate, but it may be applied with equal advantage to a single one. The gates run on a horizontal bar supported by posts which also support a protective covering. Two posts, set up on opposite sides of the gate, and equally distant from it, support pulleys around which passes the endless rope, A, which also passes around two pulleys on one of the gate posts and one pulley on the opposite post, bringing two strands of the rope above the gates in a horizontal position. The lower strand has a strong loop through which passes an arm projecting upward from one part of the gate. This loop is of sufficient length to admit of moving the rope a short distance without moving the gate. The upper strand of rope is connected with the other part of the gate by a three-armed lever, D, which is pivoted to an arm projecting upward from the gate. The lever, D, is connected with the gate latch, and the first operation on pulling the rope is to unfasten the gates; a further movement of the rope opens the gate. A person in a carriage or upon horseback may readily open the gate by grasping the handle, B, and drawing it along as he proceeds. After passing through the gate the handle, C, is grasped and the gate is closed. The operation of the gate is the same whether approached from one direction or the other.

ALLEN'S IMPROVED GATE.



BURNS' MOULD FOR SEWER BUILDING.

IMPROVED MOULD FOR SEWER BUILDING.

The annexed engraving represents an improved mould or centering, used in sewer building, and is adapted to any of the sewer building materials in common use, such as concrete, artificial stone, or brick, and is made of convenient length and of the proper form for a sewer, and is mounted on wheels and made collapsible, so that after a section of sewer is built it may be contracted and moved into a convenient position for building another section.

The frame of the mould consists of a top cross rib, *a*, at each end, to which are pivoted vertical side ribs, *b b*, having their lower ends connected by toggle bars, *c*, which retain and brace the ribs, *b*, when the mould is expanded. The ribs, *a b*, are covered by a sheathing, *d*, of wooden slats or sheet metal, except at the bottom, which is left open. Extending lengthwise through the mould, and sustained by ribs, *a*, there is a shaft, *d'*, from which chains or ropes, *i*, extend to the jointed bars, *c*. The shaft, *d'*, project beyond the ends of the mould, and is provided with crank handles, by which it can be turned to wind the chain, and thereby draw the sides of the mould inward.

The mould is supported on wheels, *e*, fitted in supports at the lower ends of the side ribs. These wheels facilitate the labor of shifting the mould as the work progresses.

In building sewers with this mould, a bottom or base, of stone or concrete, is first laid in the trench at the required grade, and when this is set the mould is placed thereon and the sides and crown of the sewer formed around it. A head is attached to the end of the mould by screws or other fastenings, and projects as a flange, serving as a gauge for the thickness of the wall. When the section is completed the head may be removed and the shaft, *d'*, turned to draw the sides of the mould inward. This action allows the mould to drop down, so that the sides and crown are relieved, and the mould may be then drawn out to the position required for the next section, and expanded by relieving the chain.

Springs, *g*, attached to the bars, *c*, and ribs, *b*, tend to draw bars, *c*, downward and expand the mould. There are also braces, *h*, hung on the ribs, *a*, which, when the mould is collapsed, catch on pins in side ribs, *b*, giving rigidity to the mould while it is being withdrawn.

To prevent the sides of the mould from being forced inward when the sides of the sewer are rammed, the joint of the bars *c*, are fitted to drop slightly below the center line when the sides are expanded, and the springs, *g*, aid in accomplishing the same object. By the use of this mould a sewer may be built rapidly to any grade, with top and sides of uniform thickness, without joints, and with a smooth interior surface. The trench may be filled as the work progresses up to the crown of the sewer, and the side walls thus strengthened while the material is setting.

This invention was recently patented by Mr James Burns, of San Antonio, Texas.

POODLE MOTORS.—At the recent Applied Science Exhibition, Paris, M Richard, a clothier, exhibited a motor which was turned by a poodle dog, confined in a revolving cage. The dog was able to drive four sewing machines. Women who have heretofore been accustomed to support their poodle dogs in idleness may now make them useful.

NOVEL METHOD OF CARPETING STAIRS.

We give herewith an engraving of a new method of carpeting stairs recently patented by Mr. T. F. Walter, S. E. corner 20th and Brown streets, Philadelphia, Pa. Instead of a continuous carpet extending from the top to the bottom of the stairs in the usual way, each step is provided with its own carpet, which may be put on or taken off independently of the other steps. These sections of carpet are secured to the steps at the rear by tacks, and at the front by the moulding under the nosing. A band of brass or other metal, either plain, ornamented, nickeled, gilded, or enameled, extends across the ends of the carpet, and curving over the nosing is furnished with a metallic pendant.

WALTER'S METHOD OF CARPETING STAIRS.

Stairs carpeted in this way present an elegant appearance, and accord with the modern style of house furnishing. The carpeting is adapted to stairs of all widths, and little more than half the usual quantity of carpeting is required. The rods, while costing less than the ordinary styles, are much more ornamental and secure. There are several other advantages in this style of carpeting which will be apparent to those interested in this subject, not the least of which are the doing away with the use of covering to hide worn places that would otherwise appear when the carpet is moved up or down, and the facility with which any or all of the small pieces may be removed from the stairs and cleaned.

We call attention to Mr. Walter's advertisement in another column.

A NOVEL SMALL MOTOR.

A small, safe, and easily managed motor adapted to domestic use and suitable for driving small machinery of various kinds is one of the things that has long been wanted, and we are pleased to be able to present to our readers several engravings of a motor of this description which is made by reliable parties and is now being extensively introduced.

The Tyson motor possesses some novel features which are well worthy of careful examination. It is a steam engine with a non-explosive steam generator, and without a steam gauge, water gauge, or safety valve, and its boiler or generator has but one-fiftieth the cubical capacity of an ordinary boiler adapted to the same engine.

Fig. 6.—TYSON BRACKET ENGINE.

In the smaller sizes of these engines either gas, coal oil, or gasoline may be used as fuel, and for the larger sizes coal and wood may be added to the list.

The fact that this engine is perfectly safe, even in the hands of the inexperienced, is a great point in its favor. It may be run by any lady who is competent to operate a sewing machine. It is beautifully finished and may be placed in the parlor, sitting room, bed chamber, or kitchen, and may be employed in running sewing machines, knitting machines, ventilating fans, and all kinds of light machinery used about the house. It may also be used for running coffee mills, printing presses, dental lathes, in fact it may be applied to all machines usually driven by a treadle or hand power.

The general appearance of this new motor is well represented in the central view in the larger engraving, while its application to small machinery is shown in the smaller views, Fig. 1 showing it in connection with a sewing machine, Fig. 2 shows a lathe, and Fig. 3 a scroll saw driven by it. Fig. 4 shows an application too obvious to need description, but it suggests the possibility of comfort in the sweltering days

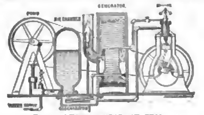


Fig. 7.—TYSON MOTOR SYSTEM.

of mid-summer. Of course the variety of machinery to which the motor may be applied is unlimited. The style of engine shown in the engraving has a power equivalent to 1,000 foot pounds per minute, and is quite sufficient for a great variety of purposes; but we are informed that larger sizes are soon to be made so as to cover a wider range of application.

Fig. 5.—TOP OF TYSON MOTOR.

Fig. 5 is an enlarged view of the upper portion of the engine, showing the oscillating cylinder, the generator, and the pump. Figures 3 and 6 show the engine adapted to a wall bracket.

Fig. 7 shows the relation of the various parts of the engine, and illustrates the operation of the system. The pump is worked by hand to produce pressure in the air-chamber; this chamber is connected to the steam chest of the engine by means of a long pipe, part of which is coiled in a receptacle through which exhaust steam from the engine has egress, and part in a furnace. The water is converted* into steam, in its transit through this pipe, and steam is delivered to the engine at the pressure produced by the pump. When the engine is started it imparts motion to the pump, and the preinduced pressure is maintained; thus it will be seen that the function of the generator is to create volume, not pressure. Should the

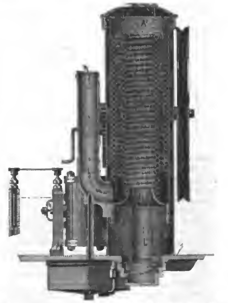
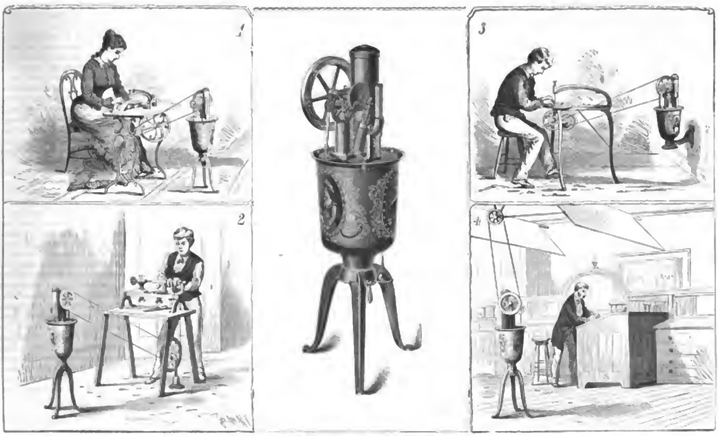


Fig. 8.—VERTICAL SECTION THROUGH GENERATOR.

engine be stopped and the fire continue to burn, the water in the coil is forced back to the air chamber, and the production of steam is thereby checked; the engine being again started, the pressure in the air chamber again forces water through the heated coil, and the generation of steam is resumed. In running these small machines about all that it is necessary to do is, to pour in a few quarts of water once in four or five hours. The construction is such that there can be no explosion even if the water becomes wholly exhausted. In that case the machine simply stops till water is supplied.

A relief valve at the right of pump limits the pressure; this valve is in no sense a safety valve, for even if it were

* The inventor states that in practice it is best to flash highly-heated water into steam.



THE TYSON SMALL MOTOR.

fixed so as not to yield to pressure, no explosion could occur—the mechanism of the pump not being strong enough to produce a bursting pressure.

This engine is the invention of Mr. Charles Tyson, of Philadelphia, and it is now being manufactured in handsome styles and introduced by the Tyson Engine Company, 1301 Buttonwood street, Philadelphia, Pa., to whom all letters should be addressed.

New Type of Torpedo Boats.

The torpedo boats used in the English Navy are of two kinds—those of the Lightning class measuring 84 feet in length and 100 feet 10 inches in beam; and those of the second-class, 60 feet long by 7 feet 6 inches broad. It has, however, been found from experience that first-class torpedo craft of the dimensions hitherto constructed are not sufficiently seaworthy to go out in any weather, and many governments are, in consequence, adopting a larger size. Messrs. Yarrow & Company, of Poplar, are at the present time engaged in building several of the new type of torpedo boats for various governments, including those of Russia and the Argentine Republic. They are 100 feet in length by 12½ beam, and are intended to be capable of going to sea under all conditions of weather unattended by other vessels. Their fuel carrying capacity will be sufficient for a run of 1,000 miles. They are also built much stronger and heavier than has been hitherto the practice, and are expected to realize a speed of 19 knots.

New Steam Frigate.—The Largest in the World.

The following from the *Mechanics' Magazine* of about forty years since affords an interesting comparison with the dimensions of ships of to-day: "The Admiralty have given instructions for the building and equipment of a new steam frigate, which is to surpass, in size and power, every thing of the kind yet afloat. She is to be of 650 horse power; to have engine room for 600 tons of fuel; complete stowage under hatches for 1,000 troops, with four months' stores and provisions, exclusive of a crew of about 450 men; and is to be armed with 20 guns of the heaviest caliber, besides carronades. The Cyclops, Gorgon, Geyser, and other war steamers now talked of as wonders for magnitude, will sink into insignificance as compared with this; the largest of them will be little more than half her size. For the sake of greater expedition she is to be made out of one of the large class frigates lately built (the Penelope, cut in two, with 55 feet in length added). The originator of this plan is John Edye, Esq., the able assistant surveyor of the navy (well known to all naval architects for his invaluable work on the "Equipment, Displacement, etc., of Ships and Vessels of War"), and she is to be completed at Chatham Dockyard, under his immediate superintendence and direction. The engines are to be on the Gorgon plan, and the commission for building them has been given to the inventors of that plan, Messrs. John and Samuel Seward. The vessel is expected to be fully completed and ready for sea before the close of the present year.

"The conduct of the government in this matter—conduct alike admirable for its vigor and promptitude—is, under the existing circumstances of the country, of a nature to give very general satisfaction. By nothing can such disasters as have lately befallen our arms in the East be so effectually repaired, or their recurrence more certainly prevented than by the fitting out of a few such leviathans of war as that which we have now described as being in progress. With half a dozen ships of this force at command, 6,000 men might within three weeks from the first receipt of the news from Afghanistan have been landed at Alexandria, marched in six days through Egypt (with leave of its Viceroy) to Cosseir, on the Red Sea, and transported thence in nine days more to Kurrackee, on the south coast of Scinde. With such a force there is hardly a corner of the world which British thunder could not reach in early time enough to uphold, against all opposition, British influence when linked in honorable alliance with the interests of human civilization and happiness (may we never know any other!). It is, moreover, a simple mechanical fact, which admits of no denial, that Great Britain can show forth a power in this way (thanks to her mechanics! thanks to her workshops! thanks to her practical science!) which no other country in the world can at all approach, far less rival. Every year, for the last half dozen, has witnessed some paper decree for the formation of a French steam navy, with engines of 300, 400, and 500 horse power, but where are they? It is notorious that all France has never yet been able to produce an engine, good for anything, of more than 200 horse power. Were such an order, as has been just given by our Admiralty for a pair of 325 horse power each, to be furnished in nine months, to be given by the French Government to French manufacturers it could not be executed (if at all) in as many years."

ITALIAN PRIZES FOR AMERICAN VINES.—The London *Times* reports that the Italian Government has offered three prizes, amounting to $1,800, for vines raised from grafts of American varieties of grapevines capable of resisting phylloxera.

MILLER OIL CAN PATENT.—The House Committee on Patents agreed, Feb. 24, to report favorably to the House the bill extending the patent of Henry Miller on oil cans.

CHEAP SPECTROSCOPE.

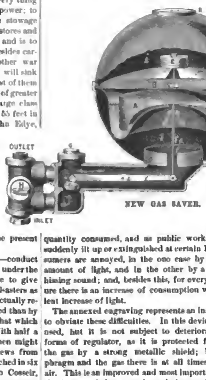
The Fraunhofer lines in the solar spectrum, and some of the bright-line spectra, can be seen by the aid of the following simple arrangemen

Make the slit in a piece of thin (very thin) sheet copper,

by laying it on a smooth surface—a planed deal board, say—and cutting the slit with the aid of an old sharp knife and a hammer. Get a piece of tubing with a shorter piece sliding in it to carry the slit, S, in the figure. The collimating lens, C, may be about 8 inches focus, and is placed its focal length away from the slit. A prism, such as may be bought for 50 or 75 cents at the optician's, held at P, will show a spectrum to the eye at E.

NEW GAS SAVER.

One of the difficulties connected with gas illumination is that the pressure in the mains varies considerably in different parts of a town or city, and at different hours of the day and night, consequently a system of lighting, adapted for a part of a town situated in a low level, will show inferior results in a more elevated situation. A rise of ten feet gives, roughly, a tenth of an inch of increase of pressure, as indicated by the manometer, so that it may easily happen that in the same town or city the pressure in one place may be one inch, while in another it may be two and a half inches. Again, the pressure of the gas, as sent out from the gas works, varies from time to time, in accordance with the quantity consumed, and as public works, shops, etc., are suddenly lit up or extinguished at certain hours, private consumers are annoyed, in the one case by falling off in the amount of light, and in the other by a flaring flame and hissing sound; and, besides this, for every increase of pressure there is an increase of consumption without an equivalent increase of light.



NEW GAS SAVER.

The annexed engraving represents an instrument designed to obviate these difficulties. In this device a diaphragm is used, but it is not subject to deterioration, as in other forms of regulator, as it is protected from contact with the gas by a strong metallic shield; between the diaphragm and the gas there is at all times pure atmospheric air. This is an improved and most important feature, which, the inventor informs us, is entirely new in this class of inventions. The valve is perfectly balanced, and operates so that no matter how great or variable the pressure may be, it cannot operate on the surface of the valve. This arrangement obviates the necessity of putting on and taking off weights. The main mechanism is contained in a spherical copper case, connected to a hollow arm or casting at the bottom. At the end of the casting there is an inlet and an outlet, arranged for connecting a by-pass cock, H. The edges of a float, A, dip into the well or trap, C. This well or trap is primed with glycerine, a fluid that is neither volatile nor affected by heat or any degree of cold, and will never require changing. It prevents the gas from coming in contact with the diaphragm, and insures a perpetual seal around the cup, A. Across the center of the case there is a diaphragm, B, which prevents the glycerine from being displaced by the pressure of the gas, also prevents spilling of glycerine by accident. This peculiar formation of the glycerine holder or trap renders the moderator transportable to any distance and in any position

When the by-pass cock is closed the gas will pass over the valve, D, and fill chamber, I, and the space under cup, A, as shown by the arrows. The cup, A, diaphragm B, and rod, F, are equally balanced by the valve, D, on the fulcrum, *d*, and lever, *f*. The pressure of the gas will raise the cup, A, and in doing so the rod, F, will be lifted, when the lever, *f*, will throw the valve, D, down on its seat.

To adjust the valve to the proper rate of pressure for gas, small weights are placed at E. When one burner is opened the cup, A, drops and opens the valve and lets out of the gas meter just enough gas for that one, and at a rate of pressure from which all the light is derived from gas, and so on for every burner that is opened. If one burner is closed the cup, A, rises, causing the valve, D, to close also, and so on for every burner that is closed.

If the pressure from the gas works increases while using one or more burners, the valve, D, drops and retards the flow of gas. If the pressure goes down at the works, the valve, D, opens and lets out more gas. This device is, in fact, a self-acting valve on the meter or mains, and the inventor claims that no amount of personal watching can equal this simple device.

By opening the by-pass cock the gas will go direct to the burners without being operated upon by the moderator.

The inventor of this instrument is Mr. J. S. de Palos, of Room 34, No. 206 Broadway, New York.

The Leyden Jar.

Mr. E. H. Gordon delivered lately a lecture at the London Institution on "The Leyden Jar." The lecturer proposed to tell his hearers something about this important portion of electrical apparatus, that they might see whether the study of its phenomena might not shed some welcome light on the way in which electrical forces acted in the great field of nature. The invention was arrived at accidentally, in 1746, by a Leyden University student, named Cuneus, who was trying to electrify water, and in the course of the experiment, having first unconsciously made himself part and parcel of a reservoir full of stored-up electricity, afterwards converted his body no less innocently into a discharging rod. The shock he got was so smart as to force from him the exclamation that not for the whole kingdom of France would he expose himself to such another. Subsequent investigation led to some clearing up of the phenomena and to the devising of safe arrangements for slowly filling a glass vessel with the electric fluid and emptying it in an instant at will. The common Leyden jar was described and its action shown and elucidated. Experiments followed with a greatly improved apparatus, which was no sooner filled with electricity than the fluid instantly overflowed like water, but in intensely vivid and loudly crackling sparks. Yet, as was experimentally demonstrated, there was no continuous stream, but only an aggregate of so many jarfuls. Moreover, the electric fluid, unlike water, could be made to fill the jar by pouring it outside. It was thus clear that the electricity acted in some way through the glass, which used to be regarded as an absolute non-conductor interposed between the two conducting surfaces, the outside and inside coatings of tin foil. The question in this, as in other instances, was one of more or less resistance to the electric strain, which many experiments proved to be very analogous to mechanical force. It was shown that in proportion as glass was heated the resistance was lessened, and other experiments illustrated the perforation of even very thick plate glass by concentrating upon one point the strain of the electric spark. Of course, the thinner the glass the more easily was it pierced. In like manner, the more rarefied the stratum of atmospheric air, the more readily did it transmit electric discharges. The experiment of the aurora tube was one of those performed in illustration of these statements

An important phenomenon in connection with the Leyden jar was the so-called "residual charge," which a faint spark showed to have collected a few minutes after the discharging rod had done its part in emptying the reservoir. This was compared with the residual recoil of an elastic body which had been bent, but which needed a second effort in resuming its original position. What was more, Professor Ayrton's experiments on this problem, which were not only unpublished as yet, but had not even been laid before the Royal Society, proved that the phenomena in the two cases were the same in degree as well as in kind. The researches of Dr. J. Hopkinson, F.R.S., authorized the conclusion that the electric strain which spanned the cosmical spaces, as in the instance of the magnetic storms caused by sunspots and disturbing our electrometers, was as mechanical in its action as that transmitted through short distances, and which was quite under our own control. Lastly, the late Professor Clerk-Maxwell had mathematically demonstrated that the ether which fills all space was the identical medium which transmits electrical forces from the sun to the earth.

Submarine Communication with Australia.

About two years ago the Australian colonies expressed a desire for the duplication of the telegraph cable then existing between India and Australia. The Eastern Extension Telegraph Company (to whom the cable belonged) therefore sent out its managing director, Colonel Glover, R.E., who negotiated with the various colonies on the spot, and agreed, on behalf of the company, to lay a second cable in consideration of the payment by the colonies of a subsidy of £32,400 per annum for a period of 20 years. This agreement was ratified and signed in London on the 6th of May last, and it was then stipulated that the work should be completed within a period of eight months.

Subsequently, after a great portion of the cable had been manufactured, the Imperial Government became desirous of establishing telegraphic communication with its South African colonies, and entered into negotiations with Mr. Pender, who, with his usual energy, undertook to carry out their wishes. As it was of great importance that the utmost expedition should be used, application was made to the Australian colonies to allow this portion of their cable to be diverted for this purpose. This was agreed to, and the consequence was that the whole of the telegraph cable between Aden and Natal, a distance of 3,388 miles, was completed in December

last, thus bringing South Africa into telegraphic communication with England. When acceding to this diversion the Australian Governments liberally allowed an extension of two months to the time originally fixed for the completion of their duplicate cable, thus bringing it down to the end of February next.

We have now to announce that the duplicate Australian cable has been completed, and is open for traffic, thus anticipating the contract time by more than a month. The new cable takes a somewhat different route to the original. The old cable from Singapore landed at Batavia, and the messages were sent over the Dutch Government lines to Banjoewangie, at the furthest extremity of Java, where the Australian section of the cable commences. By the new arrangement the Singapore section is taken direct to Banjoewangie, thereby avoiding the Java land lines, which will effect a great saving of time and tend to greater accuracy, as the messages will pass entirely through English hands.

It will, therefore, be seen that during the last ten months the above mentioned cables, aggregating about 6,400 miles in length, have been manufactured and laid. This work has been carried out without a single drawback or difficulty arising, the credit of which is due to the perfect organization and resources of the Telegraph Construction Company, who have manufactured and laid the whole of these cables within this limited period.—*London Times.*

AMERICAN INDUSTRIES, No. 34.

[*Continued from first page.*]

use; (3) it was not subjected to sufficient strain to impair its accuracy, and (4) the pressure was borne by the end of the pitman, and not by the pin. These improvements, with a solid frame for the press, of which the bearings for the slide became a part, so materially enlarged the field in which the power press might be practically employed, that the demand for presses rapidly increased as new uses for such machines were continually found.

The manufacture of power drop hammers is also an important branch of business carried on by the Stiles & Parker Company, and the improvements which have been made in drop hammers have been almost contemporaneous with those effected in the power press. At first the drop hammer was simply a weight with a rope therefrom running over a single pulley. An early patent provided for attaching the hammer by a strap to a crank, in which were pin holes by which the height of the rise of the hammer was regulated. This was succeeded in 1863 by the friction roll drop hammer, in which the hammer was made to fall, at the will of the operator, from any height, or automatically from a given height, so as to give either a light or heavy blow as desired. Mr. Stiles has since improved upon this machine, so that the automatic and voluntary adjustment are now combined, and a uniform, an occasionally varied, or a constantly varied blow may be given at the will of the operator, and the machine is as perfectly under the control of the workman as is the hammer in the hands of the blacksmith.

The multiplicity of uses to which these improved presses and dies are now put for the saving of hand labor in forging, planing, filing, drilling, etc., it is difficult to enumerate, as there is hardly a manufacture in the country to which one or the other of them is not related, either for making the finished article or forming the machinery with which it is made. The watch-making industry, as is well known, has been revolutionized by this machinery, and there is hardly a part of a watch which is not now made by a press or a drop, or both. They have likewise caused a revolution in the manufacture of firearms, and the great precision of our modern weapons as well as their cheapness is due to the use of such machines. They are also largely used in the manufacture of tin, silver, copper, britannia, and brass ware, clock cases, locks, sewing machines, etc. Almost every description of metal cutting, trimming, punching, drawing, shaping, stamping, and forging comes within the sphere of their operation, and it is stated that of presses manufactured by this company there are over 5,000 in use in this country.

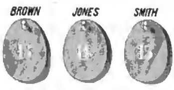
Among the work recently completed by the company are a press for making eyelets, which is calculated to turn out 8,000 a minute; a drawing press which will, at one operation, draw up clock cases 12 inches in diameter and 4 inches deep, using a blank of brass 16 inches in diameter; a press weighing 19,000 pounds, capable of punching 1 inch hole through 1 inch iron 25 inches from the edge of the sheet; a 1,000 pound drop hammer for a Connecticut firm; also a 200 pound drop for the Russian Government, this being the second one made for that government. The capacity of the establishment is being tested to the utmost by the number of orders now in hand. Among the work in progress is a large size double-acting drawing press, and a punching press to make 21,920 holes a minute, $\frac{1}{4}$ inch diameter, through iron $\frac{1}{16}$ inch thick, the press being calculated to make 80 strokes a minute, and 274 holes to a stroke, the feed being automatic. This press will weigh four tons, and they are making another somewhat similar which will weigh seven tons. Large and powerful as these presses are, however, they do not compare with one which the company has lately been asked to make, and the feasibility of which they are now considering, viz., a press which will make, at one time, 120 $\frac{5}{8}$ inch holes through $\frac{5}{8}$ inch boiler iron. This is considerably beyond the capacity of any press yet made, and while the proposition marks the extreme of present development in the press manufacture, the fact that it is entertained indicates yet greater possibilities for the future.

In the engraving on the first page of this paper the group of buildings in which the business of the company is carried on is represented in one of the views. The building at the right is the foundry, which now has but one cupola, but another is in course of construction. Here is done all the casting required, and the amount of metal run usually varies between two and five tons a day. To the left of the foundry is the main building, the whole of the ground floor of which is occupied as a general machine shop, the second floor being used for making dies and patterns and as a tool room, while the top floor is filled with patterns, the accumulations of many years' work on a wide variety of machinery. To the left of the main building is the blacksmith shop and forging department, and in the rear, connecting with the main building and with the blacksmith shop, is the engine and boiler room.

In the right of the foreground of the main room, as shown in the large illustration at the bottom, is a drop anvil, the base for a drop hammer in course of construction, the upright parts of which are lying at its side. To the left of this may be seen mounted on a box, its stand not yet having been supplied, a shearing press for cutting tin, which, by an automatic fixture, throws the good blanks in one box and the scrap in another. To the rear of these, and in the center, are large punching and perforating presses nearly completed, while on both sides of the room extend lathes, planers, milling machines, etc. Some of the lathes here are of extraordinary length, for use in making shafting, while one has a capability for taking unusually wide and heavy pieces.

In the blacksmith shop, as shown in the upper right hand engraving, is a steam hammer, capable of striking a blow of 10 tons for very heavy work, and a power drop hammer for general forging. This department is conveniently arranged, and is fitted up for doing forging of almost every kind, large and small.

In the tool room, as shown in the upper left hand view, is a gear cutter, which will cut any size gear from 1 to 60 inches. Here also are milling and die sinking machines and tool makers' lathes, but the principal interest attaching to this department is in the system adopted by Mr. Stiles several years ago, of checking every workman with the tools taken by him to use in any part of the works, such check to remain against the workman until the tool is returned. As this system, or something on the same principle, has since been adopted in many other large machine shops, we herewith illustrate the plan originally started by Mr. Stiles. All the workmen who may require tools are numbered, and their names and numbers put in a rack in the tool department, with, under each man's name and number, a number of metal tags, as follows:



When a workman requires a tool from the tool room, one of the metal tags on the hook under his name is put in the tool rack in place of the tool, and there remains until the tool is returned, when the tag is again placed on its hook beneath the man's name. The number of tools out, and who has them, can thus be seen at a glance. An effectual check is thus put upon the carelessness of workmen, who might leave tools lying around after they were through with them. This, however, is only one feature of a complete system which marks the conduct of the business in every department. Each room has a competent foreman. Mr. Stiles has the general superintendence, and gives the business his personal attention.

As has been so generally the case with successful American inventors, Mr. Stiles has carved out his own way in this his chosen line of business. He was born in Agawam, Massachusetts, in 1834, where his father was a farmer, but the latter lost his property when young Norman was but five years old. His mechanical turn of mind manifested itself at an early age, and when he was but ten years old he built an extension to his father's house, doing all the work himself—carpentering, joining, painting, etc. When he was about twelve years old he built a small fire engine and a miniature working steam engine. At sixteen he earned a journeyman's wages in making tin ware; and from the age of eighteen to twenty-one, he worked as an apprentice in the American Machine Works, at Springfield, Mass. In 1857 he established a small jobbing machine shop at Meriden, Conn., and then began to pay particular attention to the making of dies and presses. From that time to the present his mechanical skill and inventive turn of mind have been principally exercised in matters pertaining to these specialties, with practical results of which we have substantial evidence in almost every machine shop in the land.

A Coal Miner's Day's Work.

In a recent article on the use of compressed air in coal mining (SCIENTIFIC AMERICAN, February 7) it was stated that a day's work for two able-bodied miners is the bearing in of $2\frac{1}{2}$ feet across 15 feet of coal. Mr. Charles Wyld, of Carbon, Indiana, writes that his usual day's work is to bear in from four to six feet in depth a distance of from twelve to fifteen feet; in other words, he does twice as much in a day as was allowed for two men in the article referred to. We make the announcement with pleasure, but regret that Mr. Wyld did not say whether his fellow miners do as well as he, or whether the average bearing in under all conditions is greater than the article stated.

AGRICULTURAL INVENTIONS.

Mr. Willis D. Green, of Mount Vernon, Ill., has patented an attachment for grain drills, by which, as it follows the delivery spout, the earth is pressed about the grain, packing it more closely at the sides than at the top, and pressing the soil down, forming channels, which will be gradually filled by the falling in of the sides, thus hilling the stalks of grain as they come up.

Mr. William A. James, of St. Louis, Mo., has patented an improved sulky plow provided with novel means for readily adjusting the various parts. The invention cannot be fully described without engravings.

Mr. David A. Swanson, of Rio Grande, O., has patented a combined hand corn planter and fertilizer distributer which is so constructed that the corn and fertilizer will be deposited at the same time and at the same depth or at different depths, as required.

Mr. Chapin C. Brooks, of Lancaster, N. H., has patented a reversible or side hill plow so constructed as to turn a furrow in either direction upon level or hilly lands.

Chasse's Multiplex Telegraph.

For some months a Frenchman, named Chasse, has been promulgating the most astonishing claims with regard to an alleged new process of telegraphing, by means of which an indefinite number of messages might be sent simultaneously in opposite directions over a single wire.

A few days ago practical telegraphers were invited to witness a demonstration of the process at the inventor's workshop in Hartford, Conn. There were eighteen telegraphic instruments at each end of the room, all connected with a single wire, supposed to represent a cross country line. Eighteen messages were sent each way, all at once, apparently through the single wire.

Among the witnesses was Mr. William Hadden, of the American Union Telegraph Company, who noticed that the insulated connecting wires were neatly fastened to the wall by double-pointed carpet tacks. On pulling one out he found that beneath each tack the covering of the wire had been neatly cut away, and an ingenious system of false circuits established by fine wires leading from the tack legs. The supposed cross-country wire was a sham and the too promising multiplex telegraph a clever cheat.

A Log Railroad.

A log tramway or railroad in use by the Richardson Brothers at their mill, south of Truckee, is a very ingenious piece of machinery. Logs, ten inches or a foot in diameter, are hewn round and smooth and their ends are coupled together by iron bands. These logs, laid side by side upon graded ground for a distance of perhaps three miles, form the track. Of course the road looks quite like an ordinary railroad track, except that logs are used instead of rails, and the ties are at much greater intervals. The wheels of the engine and cars are concave on their outer surface, and fit the curve of the logs. The power is applied to a wheel in the middle of the forward axle on the engine. The most remarkable loads of logs are hauled upon the cars, and the affair is a decided success. It is very cheap, its construction is simple, it is not easily damaged, and its operation is all that could be desired. By means of this log railroad the Richardson Brothers are enabled to get their logs to the mill from the forest, three miles distant, at a cost far less than it is ordinarily done.—*Truckee (Nev.) Republican.*

Decline in the British Flax and Linen Trades.

The recent report of the British Factory Department shows a remarkable decline in the linen trade of Great Britain during recent years. In 1871 there were in England, Scotland, and Ireland 500 factories; in 1878 there were only 400, the diminution showing chiefly in factories where spinning only is carried on. The number of spindles declined during the same period from 1,553,335 to 1,264,766. The number of operatives decreased from 124,772 to 108,806. The acreage planted with flax in 1871 was 17,366; in 1878 it had fallen to 7,481. There was at the same time a large falling off in foreign imports. In the same period the exports of linen yarn declined from 36,235,625 pounds to 19,216,601 pounds; and the export of linen manufactured goods from 220,467,476 yards to 177,776,527 yards.

BENJAMIN FISH, of Trenton, N. J., has rounded up 94 years of a remarkable existence. He lent Commodore Vanderbilt $1,000 when that gentleman first started out in his career; brought down the first anthracite coal that descended the Delaware in 1825; managed the old stage line and steamboat company between New York and Philadelphia, fifty-five years ago; was one of the first directors of the Camden and Amboy Railroad, in 1830, and has been elected every year since. In 1833 he drove the first freight car that moved over the road between South Amboy and Bordentown. Horses were used that year. The first locomotive was imported from England; it is now standing in the shops at Bordentown, and is known as "Johnny Bull" and "Number One."—*Railway World.*

IMPROVED CONTROLLING VALVE FOR ENGINES.

The annexed engraving shows two forms of controlling valve, invented by Mr. N. E. Nash, of Westerly, R. I., designed for application to engines doing variable work, such as hoisting, punching, and shearing metals, and many other varieties of work requiring an intermittent power.

The engraving shows one of the valves in longitudinal section, and the other having parts of the valve casing broken away to show the arrangement of internal parts.

The valve shown in Fig. 1 is similar to an ordinary globe valve on one side of the central partition, but a cylindrical ported extension, A, on the under side of the valve seat, is fitted with a plug or key, B, which is provided with ports corresponding with those of the part, A. The plug, B, has a stem, C, extending out through a stuffing box and provided with a hand lever by which the valve is opened or closed. The screw valve is adjusted to the maximum amount of steam, while the plug valve is used to reduce this quantity, more or less, down to just what would be required to keep the engine in motion.

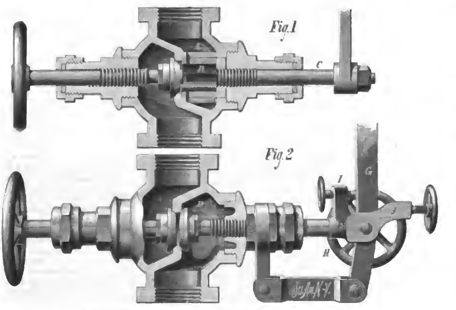
In this valve the stem, C, is screwed into the plug, B, and the first result of moving the valve lever is to loosen the valve in its slightly conical casing, so that when it is turned by the further movement of the lever it is not worn by contact with its bearings.

Fig. 2 shows a valve which answers the same purpose as that shown in Fig. 1, and like that valve, one half of it is similar to a common globe valve. The valve seat is provided with a supplemental valve adapted to be opened and closed independently of the main valve, but which is inoperative except when the main valve is open. By this arrangement the ordinary or main valve may be used to limit the area of the valve opening, while the supplemental valve is employed to open and close the limited aperture.

The stem of the supplemental valve, D, extends through an ordinary stuffing box, and is provided with a forked head in which is pivoted the hand lever, G. This lever is fulcrumed in a link jointed to an arm projecting from the stuffing box. The pivot of the lever, G, in the forked head, F, is in reality a clamping screw provided with a hand wheel, H, and capable of drawing the two arms of the head, F, together so as to bind the lever, G, in any desired position. The motion of the lever, G, is limited in both directions by two screws passing through the arms, I J. By properly adjusting the screw in the arm, I, the minimum of steam supply is regulated and the maximum is regulated by turning the screw in the arm, J.

The advantages of these valves will be at once recognized by engineers and machine owners running engines at variable speeds or where a variable power is required. The main valve may be set and locked by some person in authority to give the desired maximum velocity to the engine, when the supplemental valve may be operated by an unskilled attendant without danger of injury to the engine or machinery connected with it.

Further information may be obtained by addressing Mr. J. M. Pendleton, Westerly, R. I.

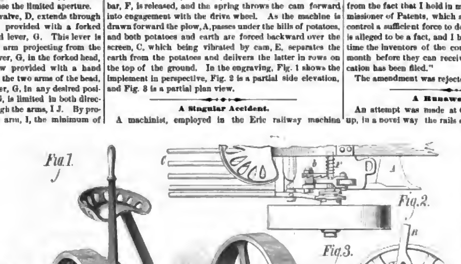


NASH'S CONTROLLING VALVE FOR STEAM ENGINES.

NEW POTATO DIGGER.

The improved potato digger shown in the accompanying engraving is the invention of Mr. James B. Taylor, of West Hurley, N. Y. It is not only adapted to digging potatoes, and freeing them from earth, but it may also be used to advantage for loosening the soil and destroying grass and weeds between the rows.

The plow, A, is suspended from a long bolt that extends across the rear of the machine frame, and is provided with a curved arm which is jointed to a lever, B, pivoted to the main frame and capable of engaging with a ratchet, *b*, so as to hold the plow at any desired elevation. A screen, C, consisting of a series of fingers projecting from a cross bar, is pivoted at one side of the machine, on the same bolt that sustains the plow, and is provided with an arm, D. At the opposite side of the machine the screen is supported by a small roller also on the bolt that supports the plow. The end of the arm, D, carries a roller that is engaged by a zig zag cam on the axle. This cam is movable on the axle, and is provided with lugs that may be thrown into or out of engagement with clutch teeth on the hub of the driving wheel by a shifting bar, F, which is always pressed forward by a spring tending to throw the cam into engagement with the drive wheel. The shifting bar is provided with an inclined arm which is engaged by the lever, B, whenever it is thrown back to raise the plow, thus throwing the cam out of gear. It will thus be seen that by moving the lever, B, so as to throw the plow into position to operate, the shifting bar, F, is released, and the spring throws the cam forward into engagement with the drive wheel. As the machine is drawn forward the plow, A, passes under the hills of potatoes, and both potatoes and earth are forced backward over the screen, C, which being vibrated by cam, E, separates the earth from the potatoes and delivers the latter in rows on the top of the ground. In the engraving, Fig. 1 shows the implement in perspective, Fig. 2 is a partial side elevation, and Fig. 3 is a partial plan view.



TAYLOR'S POTATO DIGGER.

A Singular Accident.

A machinist, employed in the Erie railway machine shops, Jersey City, incautiously went to sleep during the dinner hour on a bench through which a large auger works. The whistle for starting did not rouse him, and when the machinery was set in motion the auger began to bore obliquely through his leg. His cries attracted the attention of his fellow-workmen, but before the machinery could be stopped his leg was bored through just below the knee.

Mr. Vance on the Value of our Patent System.

In a discussion on the revision of the House Rules, Feb. 13, Mr. Vance moved that clause 24 of rule xi. should provide that the Committee on Patents receive the estimates and report the appropriation bills for the support of the U. S. Patent Office. After showing that the Patent Office was more than supported by the inventors of the country, Mr. Vance said:

"I think it is a reasonable proposition, as the Patent Office is supported by the money paid into it by the inventors of the whole country, that the Committee on Patents should have exclusive jurisdiction and control of the legislation affecting this great interest. While it is admitted that the interests of agriculture are of great importance to the country, it cannot be denied that the development of the country, and the development to a large extent of agriculture itself, are greatly indebted to the success of our system of patents. The interests of agriculture in this country have been greatly enhanced by the development of the patent system. There is no one department of this government which has done more for the material welfare and prosperity of the people than that. The million of bushels of grain, of corn, wheat, and every other kind of grain known to our agricultural interests have been added to and increased by the invention and successful operation of labor-saving machinery, fostered, as such inventions have been, by the patent laws of this country. I think it is true that the appropriations for the Patent Office for many years were reported by the Committee on Patents, and I see no reason why they should not continue to be reported by that committee.

"At the present time it is very important that the Committee on Patents should have control of the appropriations, from the fact that I hold in my hand the report of the Commissioner of Patents, which states that he has not under his control a sufficient force to do the work of the office, and it is alleged to be a fact, and I believe it to be true, that at this time the inventors of the country are compelled to wait a month before they can receive their patents after the application has been filed."

The amendment was rejected.

A Runaway Railroad.

An attempt was made at Oil City, Pa., Feb. 10, to take up, in a novel way the rails of a disused inclined railroad a quarter of a mile long. The hill being steep and icy, it was impossible for workmen to take up the rails by working along the road, but as the rails had been joined together at the ends when they were laid, and made continuous strings of iron from top to bottom of the hill, the plan of starting each string entire by taking out the spikes and pulling it down at the bottom was hit upon. A number of the bottom rails of one line were removed, and then a rope was attached to the rest and a team of horses set to work to start the whole. The line of rails, nearly a quarter of a mile long, started from its place, but the ties being covered with ice, a result unlooked for by the engineer in charge followed. The long string of iron started down the hill by its own gravity, and was in a few seconds rushing along at great velocity. When the lower end struck the street at the bottom of the hill the string of rails was disconnected in several places, and instantly rails were flying through the air in all directions, some of them being carried 300 feet. A long section of the line remained intact, and continued on its way. It dashed across the street, passed clear through a barn, grazed the corner of Mrs. Case's dwelling, demolished an outhouse, and continued on with apparently undiminished speed. Leaving Mrs. Case's garden, the line of iron dashed

into the back yard of the James House, and pointed directly for the kitchen of the hotel, where several girls were at work. Fortunately, something turned the flying iron a few inches from its course, and it came in contact with a stone wall. This separated the rails into two parts. One was hurled a hundred feet into an adjoining garden, where it plowed up the ground for a long distance and was brought to a stop. The other portion leaped into the air and struck a chimney on the kitchen of the hotel. From there it was thrown to the roof of a three-story house some distance away, where it tore off the shingles for twenty feet and struck a high chimney, which it partially wrecked. Its force was then spent, and the iron, a section fifty feet long, rested in the midst of the ruin it had wrought. The rest of the railroad on the hill will be taken up in the old-fashioned way.

THE LEAF MORMOLYCE.

This insect, which is found on the Island of Java, has all its members well developed. The outer wings are especially developed in the horizontal plane, and give the insect a most singular appearance. The head is connected with a disk-shaped prothorax having serrated edges. The eyes are large and prominent, and the antennæ almost as long as the insect. The outer wings are covered with longitudinal flutings crossed by a number of transverse ridges. The inhabitants call the insect the "violin," on account of its resemblance to form of that instrument. The insect is not very well known in Europe, the first being brought thither in 1820 by Messrs. Kuhl and Hasselt. The annexed engraving, which we take from *La Nature*, represents the larvæ and the insect in full size.

THE METAMORPHOSES OF THE LEAF MORMOLYCE OF JAVA.—(*Natural size.*)

Coal.

Professor T. Rupert Jones, F.R.S., lately delivered a course of three lectures at the Royal Institution, London, giving a detailed account of the organic remains, or fossil plants and animals, found in coal and coal measures, compared with those associated with other fossil fuels. He then took a comprehensive survey of the whole ground trodden throughout the course. Under one division of the subject he had pointed out that the different kinds of fossil fuel, from peat to anthracite, graduate in their composition from that of wood to that of nearly pure carbon. He had intimated that wherever and whenever large quantities of vegetable matter had been accumulated and covered up more rapidly than they had decayed, there seams of coal or of some other mineral fuel had been produced. The chemical changes which the trees and other plants had undergone after their accumulation—as fallen trunks, branches, leaves, and spores, with creeping stems, roots, and rootlets—in wet jungles and peaty swamps, had variously rearranged their constituent carbon, hydrogen, and oxygen. The results were: (1) thin laminæ of hydrocarbonaceous coal, shining or dull, which alternate with thinner films of mineral charcoal (the product of subaerial rotting), where damp forest growths prevailed; (2) layers of spores (white coal of Tasmania), or of leaves (fir needle coal of the Hanover wealden); (3) hydrocarbonaceous coals, more or less homogeneous in structure, where swamp lakes and peat bogs occupied the area of growth. Some coals might always have contained a relatively large proportion of touchwood and charcoal, and have been subjected to pressure, driving off the hydrogen with some of the carbon. In either case, anthracite coals had resulted, and natural distillation had produced various secondary hydrocarbons, such as albertite, bitumen, petroleum, and naphtha. The history of the geological strata, from mountain limestone, through millstone grit, to the coal measures, their disturbances and present position, was thus brought within the reach of man's skill and labor. The lecturer concluded by pointing out that the study of the coal measures was of great importance as a branch of natural history not to be ignored in the general scheme of a good education.

Packing Apples for Shipment.

At the recent horticultural meeting at Rochester, N. Y., Mr. Barry opened the question: "Have there been any recent improvements in the methods of packing and shipping fruit?" by asking "What is the best method of packing fruit for foreign shipment?" He used paper for wrapping the fruit in, but knew of others using chaff in addition. Mr. Vick had tried several ways, but preferred using strong manila paper in which to wrap the fruit. In packing in the barrel he placed a layer of buckwheat chaff between each layer of apples, and in the ends put a deeper layer of chaff. He had shipped several kinds with success in this manner. Mr. Hooker objected to the use of the chaff, as it would be liable to impart a flavor to the fruit. He thought that good fruit, packed solidly, would stand shipment to a foreign market. He would advise picking the fruit as soon as matured. Mr. Moody thought well of the plan of having fruit houses, where the fruit would pass through the sweating process before being barreled. Mr. Hong had a ventilated fruit house in which he allowed his fruit to cool, and where he kept it till November. Mr. Moody thought the thorough assorting of apples a necessity; they should be handled quickly and very carefully, and be left in the sun no longer than necessary. Mr. W. C. Barry left his apples in the orchard till they had passed the sweating process. He thought they should not be placed in barrels till after that—nor should they be shipped abroad till cool weather commenced. Mr. Woodward said apples should be picked early and handled but little. When they snapped easily from the stem it was time to pick them. They should not be barreled till ready for sale. Mr. Clark picked some apples the last week in October, and had but just opened them. He found them to be in good condition.

NATURAL HISTORY NOTES.

Vertical and Horizontal Leaves.—Griesbach, in his account of the vegetation of Australia (says Mr. Moseley in his "Notes of a Naturalist"), dwells on the close relation of interdependence which exists between the tree vegetation and the coating of grass which covers the ground beneath it, and remarks that the amount of light allowed by the trees to reach the ground beneath them is rendered more than usually great by the vertical position in which their leaves grow. Hence the growth of the grass beneath is aided. It may be that this permitting of the growth of other plants beneath them, and consequent protection of the soil from losing its moisture, besides other advantages to be derived, is the principal reason why, as is familiarly known, two widely different groups of Australian trees, the eucalypti and acacias, have arrived at a vertical instead of a horizontal disposition of their leaves by two different methods. The acacias have accomplished this by suppressing the true horizontal leaves, and flattening the leaf stalks into vertical pseudo leaves, or "phyllodes." The gum trees, on the other hand, have simply twisted their leaf stalks, and have thus rendered their true leaves vertical in position. There must exist some material advantages which these different trees derive in common from their peculiar arrangement, and the benefit derived from relation to other plants by this means may be greater and more important than that arising from the fact that the vertical leaves have a like relation to the light on both sides, and are provided with stomata on both faces. In support of this conclusion I was told when at Melbourne that when the native vegetation was cleared away from under gum trees they ceased to thrive and in time perished. I was shown a number of gum trees not far from the city, scattered over some public land, covered with only short turf, which seemed to be mostly in a dying condition.

The Power of Movement in Leaves of Conifers.—Dr. Maxwell Masters, at a meeting of the Linnean Society, Dec. 4, called attention to the contrasts to be drawn between the leaves of the spruce firs (*Picea*) and those of the silver firs (*Abies*), as regards their arrangement, relative position, form, relative size, and internal structure, as described by Bertrand and others. The leaves of the silver firs are endowed with a power of motion in virtue of which they are raised or depressed. On the other hand, the leaves of the spruces are comparatively motionless. In those cases where the leaves have the power of movement there is usually a well-marked layer of "palisade cells" which are absent in motionless leaves. This circumstance has led Dr. Masters to correlate the differences before alluded to with varying degrees of functional activity, and with the adaptations manifested to secure as far as possible to each leaf an equally favorable amount of exposure to light, etc. The very remarkable movements of revolving mutations observable in the "leader shoots" of many conifers during their season of active growth were mentioned as having been investigated by him and the rotation duly registered on a disk.

Migration of Plants from Europe to America.—Professor Claypole, in a lengthy paper on this subject, read before the Montreal Horticultural Society, calls attention to and enumerates the vast number of weeds which have migrated from Europe to America and become so thoroughly naturalized

here that they prevail over some of the plants native to the soil; while only three or four American weeds have crossed the Atlantic and become naturalized in Europe. Having shown that the difference in climate and the conditions of mutual commerce do not fully account for this marked difference in the migrative power of the two floras, he next points out the fact that in the Miocene era the European and American floras were very much alike, but that since that time the European flora has been vastly altered, while the American flora still retains a Miocene aspect, and is, therefore, the older of the two. Professor Claypole is led to conclude that this long persistence of type in the American flora may have induced, by habit, a rigidity or indisposition to change, while the changes in the European flora since the Miocene era betray a plasticity of nature, or power of adapting itself to circumstances, of which the American flora gives no sign. From this view, the European flora is better able to adapt itself to the strange climate and conditions—that is, to emigrate—than the American flora, and being thus made plastic or adaptable, it succeeds in the New World, while the less adaptable American flora fails in the Old World.

The Rose of Jericho.—This curious plant, which in a dried state is often sold as a curiosity, has recently been correctly and well described by the veteran botanist, Mr. J. Smith, ex-curator of Kew Gardens, in a little work entitled "A History of Bible Plants." After detailing certain passages of the Scriptures which are supposed to refer to the "Rose of Jericho," he proceeds to say: "It is an annual, having a tap root from which numerous branches are produced, forming a circular disk about a foot in diameter, at first lying nearly flat on the ground. It has small leaves, and small white flowers at their axis. When the seeds are perfected, the stems become dry, hardened, and incurved, their points meeting and forming a skeleton hollow ball, which in time (by the power of the wind) loses hold of the ground, and, being blown about, rolls and turns like a wheel." This plant belongs to the natural order Cruciferæ, and has been rendered famous by the peculiar hygrometric properties of its stem and branches. It affords a very interesting example of the means by which nature effects the dispersion of seeds. The fruit is a small roundish silicle with two woody valves each, each of which terminates at its apex in an acute point. During the dry season these plant balls are scattered far and wide by the winds over the sandy tracts of land extending from Syria to Algeria, and on the return of the rains the branches spread out, the diminutive silicles burst and release the seeds, which speedily germinate in the damp warm soil. This alternate closing and expanding of the branches continues for many years. Concerning the strange manner in which these singular plants are scattered, the traveler, Dr. Thompson, has written as follows: "When ripe and dry in autumn, the branches become rigid and light as a feather, the parent stem breaks off at the ground, and the wind carries these vegetable globes whithersoever it pleaseth. At the proper season thousands of them come scudding over the plain, rolling, leaping, and bounding to the dismay of both horse and his rider. Once, in a plain north of Hamath, my horse became quite unmanageable among them."

A Fly-catching Plant.—We have one plant in our gardens, says Knapp in his "Journal of a Naturalist," a native of North America, than which none can be more cruelly destructive of insect life, the dog's-bane (*Apocynum androsæmifolium*) which is generally conducive to the death of every fly that settles upon it. Allured by the honey on the nectary of the expanded blossom, the instant the trunk is protruded to feed on it, the filaments close, and, catching the fly by the extremity of its proboscis, detain the poor prisoner, writhing in protracted struggles till released by death—a death apparently occasioned by exhaustion alone; the filaments then relax, and the body falls to the ground. The plant will at times be dusky from the numbers of imprisoned wretches.

Consciousness in the Acquirement of Instincts.—Most naturalists, says Mr. Darwin (*Nature*, January 8), appear to believe that every instinct was at first consciously performed; but this seems to me an erroneous conclusion in many cases, though true in others. Birds, when variously excited, assume strange attitudes and ruffle their feathers; and if the erection of the feathers in some particular manner were advantageous to a male whilst courting the female, there does not seem to be any improbability in the offspring which inherited this action being favored; and we know that odd tricks and new gestures performed unconsciously are often inherited by man. We may take a different case (which I believe has been already advanced by some one), that of young ground birds, which squat and hide themselves when in danger immediately after emerging from the egg; and here it seems hardly possible that the habit could have been consciously acquired just after birth without any experience. But if those young birds which remained motionless when frightened were oftener preserved from beasts of prey than those which tried to escape, the habit of squatting might have been acquired without any consciousness on the part of the young birds. This reasoning applies with special force to some young wading and water birds, the old of which do not conceal themselves when in danger. Again, a hen partridge when there is danger flies a short distance from her young ones and leaves them closely squatted; she then flutters along the ground as if crippled, in the wonderful manner which is familiar to almost every one; but, differently from a really wounded bird, she makes herself conspicuous. Now it is more than doubtful whether any bird ever existed with sufficient intellect to think that if she imitated the action of an injured bird she would draw away a dog or other enemy from her young ones; for this presupposes that she had observed such actions in an injured comrade and knew that they would tempt an enemy to pursuit. Many naturalists now admit that, for instance, the hinge of a shell has been formed by the preservation and inheritance of successive useful variations, the individuals with a somewhat better constructed shell being preserved in greater numbers than those with a less well constructed one; and why should not beneficial variations in the inherited actions of a partridge be preserved in like manner, without any thought or conscious intention on her part any more than on the part of the mollusk, the hinge of whose shell has been modified and improved independently of consciousness?

The Kalmia and its Insect Visitors.—While it is generally admitted that the gay coloration of flowers is mainly subservient to the purpose of attracting bees and other winged insects whose visits play so important a part in the process of fertilization, one important fact has not received sufficient attention. It has already been pointed out by Mr. J. W. Slater, before the Entomological Society of London, that certain conspicuous flowers are avoided by bees, or if visited by them produce an injurious or even fatal effect upon the insects. Among such flowers are the dahlia, the passion-flower, the crown-imperial, and especially the oleander. The honey of the latter is said to be fatal to flies also. The cultivation of the dahlia has been pronounced incompatible with the success of the bee-keeper. A writer in the December number of *Science Gossip* records a few observations made on our American plant, the *Kalmia latifolia*, from which it would appear that this plant may also be included among those whose attractive flowers prove deadly to the bee which visits them for their nectar. It is a well known fact the genera azalea, rhododendron, and kalmia are narcotic, and that the honey extracted from their flowers possesses poisonous properties. Thus, *Rhododendron punctatum* yields, according to Michaux, a honey which is deleterious; and the honey of Trebizond, which is supposed to be derived from the *Azalea pontica*, has poisonous qualities which cause headache and vomiting. The flowers of *Rhododendron arboreum* of India, however, are eaten by the natives, and are likewise made into a confection by them. Notwithstanding the poisonous nature to man of the honey gathered from the flowers of these genera, no mention seems to have been made before of the fact that it is equally so to bees. The visits of bees to the flowers of the *Kalmia* have been supposed to be advantageous to the plant in setting free the anthers, which are lodged in depressions in the corolla, and which when loosened spring forward and discharge their pollen on the stigma.

Narcotism from Nutmegs.

The fact that nutmegs have strong narcotic properties has long been known, but they are in such common use as a favorite condiment used in small quantities that their dangerous nature when taken in large quantity is apt to be overlooked and forgotten, even by those who are aware of their tendency. A physician reports, in one of our medical exchanges, a case where a lady patient during his absence was induced by her old woman nurse to take nutmeg tea. One and a half nutmegs were used in making the tea, and the patient drank the whole of the decoction during the day. About 10 o'clock at night she began to get drowsy, and by 4 o'clock the next morning she was in a profound stupor. At 10 o'clock the next morning the narcotic effects of the nutmeg began to wear off, and by 4 P.M. she had pretty well recovered. The symptoms were about the same as those produced by opium, and the remedies given for them were the same.

Nutmeg in the quantity of two or three drachms has been known to produce both stupor and delirium; and dangerous and fatal consequences are said to have followed its free use in India. Mace, which is the outside covering of the nutmeg, possesses essentially the same properties.

Protection of Young Trees.

Where it is desirable to pasture sheep or hogs in orchards, or where rabbits make depredations, the bark of young trees may be successfully protected by washing the trees in spring, and again in midsummer, for sheep, and in late autumn for rabbits, with soap suds and carbolic acid, or a solution of coal tar and whitewash. Both are sure in accomplishing the end in view, and are valuable in keeping off the borer and in giving a healthy surface activity to the sap, which will make the bark look fresh and healthy. An ounce of carbolic acid to a pail of soap suds is sufficient.

Preparation of Rhea Fiber.

The Government of India, in 1870, and again in 1877, offered rewards for the discovery of a cheap and rapid mechanical or chemical process for the preparation of rhea fiber, which is at present worth from £40 to £50 per ton in England. Fifty thousand rupees for the best invention, and ten thousand rupees for the next best. A keen competition promises to take place shortly at Saharanpur, between twenty-three gentlemen from England, America, France, Denmark, New Zealand, Batavia, Hungary, and from parts of India. The judges of the trial will, says the *Homeward Mail*, have to describe the processes and determine whether the conditions of the government notification have been complied with or not, while the quality of the fiber produced will be left to experts at home.

Effects of Kidney Diseases Upon the Eyes.

The frequency with which retinal changes are found in kidney disease has been variously stated by different authorities. Earlier statistics were based on affection of vision, and the frequency assigned was altogether too low, while some ophthalmic surgeons, seeing cases only in which sight was impaired, have thought that retinal changes were almost invariable. Wagner found albuminuric retinitis in 9 per cent of the cases, Galezowsky in 33 per cent, and Laudouzy in almost every case. It is, however, well known that the frequency with which the retinal changes occur varies much in different forms of kidney disease, and it is, therefore, desirable that in observations which are made, the forms of kidney disease should be distinguished. This has been done by Mr. Eales, of Birmingham, who, in an interesting communication to the current number of the Birmingham *Medical Review*, has described an investigation of the state of the retina in 100 cases of granular kidney, the primary object being to determine the percentage of cases in which retinal changes are present. For the diagnosis of the renal disease in every case Dr. Saundby was responsible. The results contained confirm nearly the statement of Galezowsky, alterations being found in one-third of the cases. They confirm also the fallacy of taking sight as the test of retinal integrity. In 46 cases inquiries were made as to the state of vision before atropine was instilled; in 28 of these complaint of bad sight was made, but in only 6 (that is, a little more than 1 in 5) could any obvious abnormal condition be discovered in the retina; while in 18 persons, who stated that their sight was good, retinal changes, such as specks, were found in 5. The frequency with which considerable retinal changes do not materially impair sight is shown by 6 cases in which vision was carefully obtained by test types and lenses, and found, even with dilated pupils, to be nearly normal, and yet in all considerable changes were found in the retina.

The number of cases in which some abnormal change was found in the retina was 28, in 12 of which the changes existed in both eyes, while in 16 they existed in one eye only. Observers have usually described the changes as bilateral, and Mr. Eales thinks that his observations can only be reconciled with those of others by supposing that the affection often attacks one eye before the other, and that it gets well in one eye before the other. In the 12 cases in which changes were found in both eyes, 4 had diffuse retinitis, with "fibrinous" patches and œdema, and also whitish glistening patches; 1 had diffuse retinitis in one eye with only one hemorrhage in the other eye; 5 had many whitish round patches "of the atrophic kind," and 2 had only similar small patches. Of the 16 cases in which changes were found only in one eye, in 6 several white round patches were found, in 5 one or two spots only; in 1 there was a single hemorrhage near the disk; in 2 a few black specks were found, associated in one case with white specks, the black being in the center of the white speck. In addition to these 28 cases of retinal change 3 others presented slight changes in the papilla, commencing or subsiding neuritis. In 14 cases opacity of the lens existed, double and incipient in 11 cases, single in 3 cases. The presence of these alterations bore some relation to the amount of albumen in the urine, and 1 in every 2 patients with constipated bowels presented retinal changes, while such changes were found only in 1 in every 6 with open bowels.—*Lancet.*

The Transmission of Scarlet Fever by Milk.

A report has been issued by the Local Government Board on a sudden outbreak of scarlet fever at Fallowfield, near Manchester, England. The outbreak included 35 persons, belonging to 18 families, and of the individuals who suffered not less than 24 were attacked within 36 hours, between Sunday morning and Monday evening. Dr. Airy was directed by the Local Government Board to investigate this outbreak, and the results of his investigation are, says the *Lancet*, given in the report now before us. The outbreak was quite local, and the different details elicited tended to the general result that the infection had been distributed to the families through the agency of a particular milk supply. The facts bearing on this point do not well admit of any other interpretation. The question of the mode in which the milk could have become infected was not so fully cleared up, but it is shown that one of the milkers on the dairy farm lodged in a farmhouse where scarlet fever was present at the time when the milk presumably became infected, and it is suggested that the infection was communicated to the milk, in some way undetermined but not inconceivable, through his agency. The report throughout is of very considerable interest, and forms an important contribution to our knowledge of the *mechanism*, if we may so write, of certain of the observed phenomena marking the progress of infectious diseases.

American Rum Drinkers.

Referring to the drinking habits of the Americans, Mr. Read gave it as his opinion that sobriety was not so real as it appeared, for a great deal of drinking goes on privately. He said: "The American drinks so differently from the English man. They take grog as Englishmen take physic. They never meet together for sociability, hilarity, and noisy revelry; but rather go up to the bar, and taking a small glass of whisky, toss it off, and immediately follow this up by taking a glass of iced water—just as children in England take castor oil." As regards Sunday closing, Mr. Read's experience in America has convinced him that he ought not to vote for our Sunday closing bill when it comes before Parliament next session. He found that while the front door

of grog shops was closed by law, the back doors were open by the common consent of the people; and he justly remarks that "to pass laws which are never meant to be enforced is worse than passing no laws at all." Altogether, Mr. Read's visit to America has convinced him that the prohibitory policy in connection with the liquor traffic in that country has been a failure, and it would therefore be a great mistake for us to follow their example.—*Brewers' Guardian.*

THE CONDITION OF FRENCH WORKMEN.

The British Society of Arts, just before the last French Exhibition, appointed a number of experts, in different lines of business, to prepare special reports covering the state of many of the principal industries, as represented there. One of the topics to which especial attention was directed was the condition of French workmen, which is considered with reference to: 1. Hours of work and wages; 2. Rent and cost of living; 3. Organization among workmen; 4. Technical schools and art teaching; 5. Home life.

These so styled "Artisan Reports" have been published very tardily, ample time having been taken in their preparation; but the one above noticed, which has just been brought out, can hardly be said to add materially to the information which has many times heretofore been laid before American readers by the publication of our consular reports. Particular stress is laid on the long hours of which the French workman's day usually consists, the time of commencement varying more than in England or here, but the day usually lasting ten or twelve hours. Nothing, however, is mentioned in regard to the generally easy and comfortable way in which they work, as though the idea of accomplishing a certain amount in a given time was never an element in their calculation. The average rate of wages is generally lower than in England, though there are many trades in which they are about equal, or the difference is but slight. Mechanical engineers are reported as receiving 5½ francs per day of eleven hours, while smiths earn 8½ francs for twelve hours, fitters 6 to 7 francs, and pattern makers 7 to 9 francs for a day of ten hours, the wages of the smaller factories being slightly higher than those paid in the larger establishments; a first-class mason gets from 8 to 10 francs a day, and a second-class or rough mason from 6½ to 7 francs, an ordinary brick layer also receiving about the latter figure. It would not be matter of surprise, if what would be considered in America a good day's work were obtainable in France at these low rates, that the French Government is laying out such vast schemes of internal improvement, in the way of railroads, canals, grand highways, and harbor improvements, but it is questionable whether, considering the amount of labor performed, the rates are really very much cheaper than here. There is one great difference, however, and that is that nearly every one in France is employed; there are few idlers among what are known as the productive classes, and not only the men but the women and children also are active participants in the labor of bread winning.

In the matter of rent and cost of living, as compared with the rates in England, these "expert" reporters vary widely in their conclusions. Probably it would be found, that under equal circumstances, there would be little variation between France and England, but it is not easy to make a comparison that is of any value, for the French laboring classes are not only extremely economical, but a large proportion of them limit themselves even as to the amount of their consumption of the extremely coarse fare on which they principally subsist. They are frugal even to parsimony, and will generally save something, no matter how small their income, stinting themselves in their daily fare, and wearing only the coarsest clothes in order to accomplish this, in all of which they follow exactly the opposite course from the English mechanic, who will have his roast beef as often as possible, and will in anything be stinted rather than in the satisfaction of his stomach, whether he saves or runs in debt, if the latter be possible.

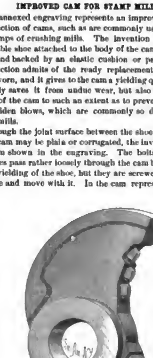
The almost entire absence of trades unions in France is noted here, as it is in almost every other treatise on French industry. The laws would not allow such associations of this kind as we have here, and the political societies or clubs, which are so numerous, though they discuss labor questions to some extent, are generally formed of members of different trades, and so have little or no influence on the rates of wages in any one industry. One great obstacle, however, to trades union organizations, and which operates most effectually in the prevention of strikes, not only in France but in Germany and other parts of Europe, is the great number of special organizations for the benefit of workmen and their families. This matter is treated as of no account in these reports, and it is stated that workmen out of employment or in distress have generally to depend on the government or private benevolence. They have not, it is true, the funds of any trades union society to fall back upon, but in a large proportion of the considerable manufacturing establishments in France a small sum is regularly set aside weekly or monthly by the employer, which is invested so as to form a fund for the relief of such cases.

Rewards are also given for exceptional merit, and for length of time in continued service, so that each year of employment in the house adds to the amount which a man or his family can obtain when old age or sickness prevents his earning his livelihood. In not a few cases, also, schooling for the children and medical attendance for the family are provided, the advantages of which are more or less freely accorded as the workman has proved himself steady and faithful. One large Paris manufacturer, employing over two thousand hands, has also founded a fund, to which he was a liberal contributor at first, and which is invested in government securities, which provides a pension on which worn-out employes, who have been in the establishment a sufficient number of years, can live comfortably on retiring, and those who remain for only five years can have, on leaving, if they leave for no misconduct or dereliction, either a small annual allowance with the privilege of again returning to work, or a lump sum if they prefer the latter. It is because there are so many benefits of this kind, accruing from continued employment and good character, in a large proportion of the French manufacturing establishments that we have so little of strikes there. There is a hearty good will and accord between employer and employed, which is not generally found here, and which goes farther to prevent labor troubles than all the laws which governments can enact or the payment of even the highest rates of which the most ardent trades unionist could ask.

IMPROVED CAM FOR STAMP MILLS.

The annexed engraving represents an improvement in the construction of cams, such as are commonly used in lifting the stamps of crushing mills. The invention consists in a removable shoe attached to the body of the cam by means of bolts, and backed by an elastic cushion or packing. This construction admits of the ready replacement of the shoe when worn, and it gives to the cam a yielding quality, which not only saves it from undue wear, but also modifies the action of the cam to such an extent as to prevent all violent and sudden blows, which are commonly so destructive to stamp mills.

Although the joint surface between the shoe and the body of the cam may be plain or corrugated, the inventor prefers the form shown in the engraving. The bolts which hold the shoes pass rather loosely through the cam body to admit of the yielding of the shoe, but they are screwed firmly into the shoe and move with it. In the cam represented by the



MOORE & DYKES'S CAM FOR STAMP MILLS.

engraving three bolts are employed to hold each shoe, but we are informed by the inventors that two bolts are sufficient.

In case the shoe becomes beveled after considerable wear it can be changed from one arm of the cam to another, or to any other cams in the battery.

This useful improvement has been recently patented by Messrs. L. A. Moore and J. Dykes, San Francisco, Cal.

Zincography for Amateurs.

In a recent paper read before the London Society of Arts, Mr. Thomas Bolas, F.C.S., described zincography as a simple and easy mode of printing in the following fashion: Zincography, he said, is similar to lithography, except that a zinc plate is employed in the place of the lithographic stone. The so-called transfer paper is merely a moderately fine paper which has been brushed over, on one side, with a mucilaginous mixture, prepared by boiling together the following: Water, 1,000 parts; starch, 100 parts; gamboge, 6 parts; glue, 1 part. This paper is written upon with the ordinary commercial lithographic writing ink, which has been rubbed up with water like an artist's water-color. The writing being dry, it is necessary to moisten somewhat the back of the transfer by means of a damp sponge; after which it is laid face downward on a sheet of ordinary roofing zinc, which has been previously cleaned by means of emery cloth. Both being now passed together under the roller of a small press, the transfer adheres to the metal plate; but on damping the back of the paper it becomes easily removable, leaving the writing on the zinc. The face of the zinc plate is now gently rubbed over with mucilage of gum arabic, which is all the better for being slightly sour, and the excess of gum having been sponged off, an India rubber inking roller, charged with ordinary printer's ink, is passed over the still damp zinc plate a few times. The ink takes only on the lines of the transferred writing, and it is now merely necessary to lay a sheet of white paper on the plate and to pass both through the press to obtain an impression—an exact reproduction of the original writing.

Any number of copies can be printed by repeating the operations of damping and inking. The zincographic process, thus simplified, is rapid, economical, and within the reach of every one.

Why Teeth Decay.

Upon a careful review of the opinion and experiments of our best investigators, says Doctor S. M. Prothro in a paper read before the Tennessee Dental Association, it is conclusive that there are but two active agents in the process of dental caries, namely the action of acids and the development of a vegetable parasite, the *Leptothrix buccalis*. By actual experiments it is demonstrated that it does not require strong acids to separate the phosphoric and carbonic acids from the lime contained in the tooth substances. Even water that contains carbonic acid will dissolve the calcareous salts. And it seems from a circumstance that transpired under the eye of Mr. Spence Bate, that water alone can dissolve the teeth. A lady having two sets of artificial human teeth, placed one set in water to preserve it till she had worn out the other. At the expiration of seven years, the set that she had kept in water was as much corroded as the one she had worn in the mouth. This case corroborates a statement made by Wedl and Heider, that at the end of ten days fungi had attacked the enamel and dentine of the teeth that had been kept in pure water, and that in a few weeks the tissues were pierced with holes like a sieve.

All mineral, as well as vegetable acids, act promptly on the teeth. "In forty-eight hours acetic, citric, and malic acids will corrode the enamel so that you may scrape a great portion of it away with the finger nail." Acid tartrate of lime, having a greater affinity for the lime of the tooth than for its own base, will rapidly destroy the enamel.

Grapes, in forty-eight hours, will render the enamel of a chalky consistence. Vegetable substances are inert till fermentation takes place and acetic acid is formed. Sugar has no deleterious effect, only in the state of acetous fermentation. Animal substances exert no injurious effect until putrefaction is far advanced.

Novel Mode of Preserving a Man's Reason.

A curious story is going the rounds of the English newspapers of an exhibition in the show windows of one of the leading jewelers of Vienna. The object of attraction is a brooch magnificently studded with gems, in the middle of whose chasing is inclosed the most singular of centers—four common, old, bent, and corroded pins. This brooch is the property of the Countess Lavetskofy. The pins have a history, of course. Seven years ago Count Robert Lavetskofy, as the story runs, was arrested at Warsaw for an alleged insult to the Russian Government. The real author of the insult, which consisted of some careless words spoken at a social gathering, was his wife. He accepted the accusation, however, and was sent to prison.

In one of the lightless dungeons in which the Czar is said to be fond of confining his Polish subjects, the unfortunate martyr for his wife's loose tongue spent six years. He had only one amusement. After he had been searched and thrown into a cell, he had found in his coat four pins. These he pulled out and threw on the floor; then in the darkness he hunted for them. Having found them, perhaps after hours and even days, he scattered them again. And so the game went on for six weary years. "But for them," he writes in his memoirs, "I would have gone mad. They provided me with a purpose. So long as I had them to search for, I had something to do. When the decree for my liberation as an exile was brought to me the jailer found me on my knees hunting for one which had escaped me for two days. They saved my wife's husband from lunacy. My wife, therefore, could not desire a prouder ornament."

The Wheat Harvest of 1879.

The wheat crop of the whole world for 1879 shows a deficiency of over 375,000,000 bushels, nearly 200,000,000 bushels of the deficiency falling to Europe. The following table, compiled from the *Bulletin des Halles et Marchés*, shows the yield for each large wheat raising country compared with the average yield:

	Average Yield Bushels.	Yield for 1879. Bushels.		Average Yield Bushels.	Yield for 1879. Bushels.
United States	337,500,000	337,500,000	Roumania	27,000,000	22,000,000
France	280,172,000	178,125,000	Belgium	19,150,000	14,650,000
Russia	190,000,000	157,500,000	Portugal	8,750,000	5,675,000
Germany	99,000,000	90,000,000	Algeria	20,500,000	16,875,000
Spain	94,500,000	78,750,000	Canada	13,500,000	13,750,000
Italy	87,350,000	67,500,000	Australia	18,300,000	14,850,000
			Egypt	13,500,000	11,500,000
Austria-Hungary	76,500,000	68,000,000	Netherlands	4,615,000	3,375,000
			Greece	3,500,000	3,375,000
Gt. Britain	88,500,000	47,500,000	Servia	3,875,000	3,812,500
Turkey	34,500,000	29,500,000	Denmark	2,250,000	2,250,000

How to Obtain Sleep.

The following is recommended as a cure for sleeplessness: "Wet half a towel, apply it to the back of the neck, pressing it upward toward the base of the brain, and fasten the dry half of the towel over so as to prevent the too rapid exhalation. The effect is prompt and charming, cooling the brain and inducing calmer, sweeter sleep than any narcotic. Warm water may be used, though most persons prefer cold. To those who suffer from over excitement of the brain, whether the result of brain work or pressing anxiety, this simple remedy has proved an especial boon."

Scientific Politicians.

Says *Nature*, Marat, the notorious hero of the first French Revolution, the same who met his death at the hands of Charlotte Corday, was the author of several important works on electricity. This fact, which is not generally known, was recently brought to notice by M. A. J. Frost, who is editing the catalogue of the Ronalds Library. Most of Marat's works were written between 1779 and 1785, and several of them were translated into German. Marat was not the only one of the prominent figures of the time who worked in physical science. Arago, though his fame does not rest upon his political achievements, once enacted a chief part in the crowning of the statue of Liberty. "Citizen" Charles was as famous among the revolutionists as for his scientific attainments. Robespierre wrote an article on the lightning conductor for the *Journal des Savants;* and last, but not least, Napoleon Bonaparte on many occasions dabbled in scientific lore, and was the liberal patron of men of science.

ELECTRIC LAMP TESTS.

The Annual Report of the United States Lighthouse Board for the year ending June 30, 1879, contains an appendix that will prove valuable to all that are interested in the study of the electric light, the different methods by which it is generated, and their relative merits and disadvantages. It contains a very full list of the appliances devised in recent times, with concise descriptions of the apparatus and principles involved, illustrated by excellent cuts, some of which have appeared in the columns of the SCIENTIFIC AMERICAN, and others taken from Dr. H. Schellen's recent work. Its compact form renders it very convenient for reference. This portion of the report had its origin in a suggestion made last fall by the chairman of the Lighthouse Board to President Henry Morton of the Stevens Institute to test the various machines and lamps in use with the view of determining their relative efficiency.

It was found that there are three ways of producing electric illumination: 1. By means of the electric arc; 2. By ignited conductors; and 3. By incandescent gases, the latter of which is hardly of practical utility.

To overcome the difficulties connected with the use of the electric arc, which consist in its unsteadiness, in the wearing away and the combustion of the carbon electrodes, etc., numerous regulators have been devised. "The difficulty with all these," we are told, "is, that however well they may regulate everything else, they cannot regulate the minute accidental variations in the structure of the carbon poles during their consumption." The effect of this is to wear away the poles unequally and to cause the arc to shift its position, so that in the space of a few minutes, the intensity of the light measured in a given direction fluctuated between 400 and 2,000 candle power. Nevertheless, since the great improvements recently made in the homogeneity of the carbon poles and in the regulating machinery, and since the introduction of reflectors, the electric arc is no longer too unsteady to use for practical purposes.

In the production of the electric light by ignited conductors, the difficulties are that there is a great wastefulness of energy and consequent costliness, and that the conductors are rapidly disintegrated. A current that would furnish an electric arc of 1,000 to 2,000 candle power would not generate a light of more than 50 to 100 candles when used to ignite a platinum wire, and the platinum so used would soon become brittle and break up.

Higher temperatures were obtained with small rods of carbon placed in exhausted tubes, but they were soon vaporized and disintegrated. At this time Edison had not yet given up platinum. The report concludes that none of the lamps so constructed have proved practically useful as yet, and then goes on to give an historical account of the different inventions of this class for future reference. To show the loss of energy resulting from the division of the current several experiments are described. In one of them a given current produced a light of 65 burners when concentrated on a single lamp; when divided between two lamps, it was reduced to 7½ burners each; among three lamps to 1½ burners each, among four to ¼; and among five to ⅛ burner.

The subject of electromotors, or instruments for producing electric currents, is treated next. To show that the galvanic battery is not economical, the following calculation is made. Weight for weight coal has almost six times the available energy of zinc, and the price of zinc is about 25 times that of coal. Hence to make gas from coal and burn it will be cheaper than to obtain electricity from zinc and turn it into light, unless the loss in the former case is 150 times greater than in the latter.

It follows from this that electric lighting did not become a practical problem until 1831, when Faraday discovered the fact that electricity could be produced from magnetism. Since then numerous magneto electric machines have been invented, seventeen of which are described and their principles explained. Of these the following were tested in the Physical Laboratory of the Stevens Institute: the Siemens, the Wallace-Farmer, the Brush, the Arnoux-Hochhausen, the Weston, and the Maxim.

The Wallace-Farmer and the Arnoux-Hochhausen machines having been withdrawn after preliminary trials, the remainder were thoroughly tested to find out which was best adapted for use in the Lighthouse Department.

To measure the intensity of the light, Sugg's photometer was used in a dark room temporarily fitted up in the Physical Laboratory. At the same time the power employed to drive the machine was measured by means of a transmitting dynamometer designed by Mr. William Kent, a graduate of the Stevens Institute.

In the following table will be found a résumé of the results obtained. The first column contains the name of the magneto-electric machine used in each series of experiments; the second contains the kind of self-regulating lamp employed, the word "hand lamp" indicating that the distance between the carbons was regulated by hand; the third column shows the amount of illumination; thus in the first line the figure number 3,297 means 3,297 times the light obtained from one standard candle burning two grains of stearine a minute; the fourth column indicates the horse power actually used; and the last column, found by dividing the third by the fourth, shows the number of candles obtained per horse power:

Machine.	Lamp.	Average candle power.	Average horse power.	Av'ge candle power per horse power.
Maxim (ordinary type)	Maxim	3,297	4·233	779
Maxim	Hand lamp	3,981	5·656	704
Siemens	Siemens	4,651	4·863	956
Siemens	Siemens	4,548	4·742	959
Weston	Hand lamp	6,365	4·789	1,330
Weston	Maxim	7,737	4·663	1,668
Weston	Siemens	7,868	5·056	1,436
Weston	Weston	6,063	4·502	1,333
Maxim (with magnets of low resistance)	Maxim	7,304	7·400	1,017
Brush	Brush	4,365	2·867	1,383
Brush	Siemens	3,582	3·073	1,194

The report concludes with the following words: "In conclusion, your committee would report that they find several of the machines and lamps, with which they have experimented, sufficiently efficient and reliable to warrant further experiment in the nature of a practical test in one of the coast lighthouses." C. F. K.

The Melbourne Exhibition of 1880.

Mr. Thos. R. Pickering, United States Government Agent for the Melbourne Exhibition, publishes the following general regulations of the Royal Colonial Commission:

1. The Exhibition will be opened on the 1st day of October, 1880, and closed on the 31st day of March, 1881. It will be open evenings.

2. There are no differential duties, and all exhibits will be admitted free of duty for the purpose of exhibition. Facilities will be given for the sale of exhibits, delivery to be made after the close of the Exhibition.

3. The protection of inventions capable of being patented, and of designs, is secured by the patent laws of Victoria.

4. If exhibits are *not* intended for competition it should be so stated by exhibitors, that they may be excluded from examination by the International Jury.

5. The general reception of articles in the Exhibition buildings will commence on June 1, and no articles will be received after August 31t. Arrangements will be made for transporting goods from the port of Melbourne, or the several railway stations, to the Exhibition grounds, at a fixed rate of charges.

6. All expenses of freight, marine insurance, etc., should be prepaid by the exhibitor, but if that be inconvenient, the Victorian General Commission, through its agents in New York and Boston, will, if desired, undertake the transportation, custom house formalities, unpacking and arranging the products for exhibition, the expense incident upon such work to be regarded as a first charge upon the exhibits, to be deducted from the net proceeds in the event of their being sold. Should such exhibits, however, not be sold, but be claimed by the exhibitor or his authorized agent at the close of the Exhibition, then such sums as may have been disbursed by the Commission or any of its agents must be paid before such goods are delivered.

7. No work of art nor any article whatever exhibited in the buildings, parks, or gardens, may be drawn, copied, or reproduced in any manner whatsoever without the permission of the exhibitor. The Commission reserves the right of authorizing the production of general views.

8. By the introduction of steam power, which will be supplied gratuitously, it is proposed to afford facilities for presenting not only the machinery for any given manufactures, but the manufactures themselves; and it is further intended that space shall be afforded for the production in the Exhibition of interesting objects by manual labor.

9. The Victorian General Commission is prepared, if required, to make arrangements for the construction of showcases by contract at a price per cubic foot, the cost to be borne by the exhibitor using the same.

10. The Commission will take precautions for the safe preservation of all articles in the Exhibition, but will be in no way responsible for damage or loss of any kind, or accidents by fire or otherwise, however caused; facilities will be afforded exhibitors for insuring their goods.

11. The awards shall be based upon written reports adopted by the jurors.

Reports and awards shall be based upon inherent and comparative merit, the elements of merit being held to include considerations relating to originality, invention, discovery, utility, quality, skill, workmanship, fitness for the purposes intended, adaptation to public wants, economy, and cost.

Awards shall consist of gold, silver, and bronze medals, and a certificate of honorable mention, together with a special report of the jurors on the subject of the award.

Each exhibitor shall have the right to produce and publish the report awarded to him, but the Commission reserves the right to publish and dispose of all reports in the manner it thinks best for public information, and to embody and distribute the reports as records of the Exhibition.

No commissioner who is an exhibitor or a member of a firm exhibiting shall take any part in the selection or appointment of jurors in those classes in which he exhibits.

No person interested either as a partner or *employé* in a house exhibiting shall be a juror in the classes in which such house or person exhibits.

The size of the medals (for prizes) will be two inches and a half, the design having been adopted.

12. Exhibitors are particularly requested to mark the trade price of the articles exhibited, so as to facilitate the judgment of the jury, as well as for the information of visitors.

13. Exhibitors will not have to pay rent for space occupied by them in the Exhibition.

REGULATIONS FOR THE UNITED STATES SECTION.

Congress having made no appropriation for the payment of freight upon goods sent to the Australian Exhibitions, and having assigned no government vessels to the duty of transportation, the United States Commission will assume no direction whatever of the movement of goods either to or from Australia.

Upon the delivery of the goods within the Exhibition buildings at Melbourne, and the payment of all charges by the exhibitors, the United States Commission will see that they are properly assigned to the space allotted the United States, and that they are catalogued.

The expense of installation must be borne by the exhibitors, and the United States Commission will not be responsible for expense of any kind in connection with the handling, storage, or the loss or injury of exhibits.

An agent with written authority duly filed, and whose qualifications are satisfactory to the Secretary of the United States Commission, will be the acknowledged representative of an exhibitor, but when goods are exhibited in the name of an agent—awards, though recommended by jurors, are not allowed by International Commissions; it would be well, therefore, for those who intend exhibiting for competition to make application in their own name.

The Buenos Ayres Exhibition.

The following are the principal regulations affecting exhibitors at the forthcoming South American Industrial Exhibition, to be held in Buenos Ayres in 1880:

1. The Exhibition will be opened on September 15 and closed on December 15, 1880. 2. Foreign exhibitors of industrial, agricultural, and all other machinery, suitable for the requirements of this country, admitted in accordance with the regulations of the Exhibition. 3. Applications for space required must be made on or before the 1st of May, 1880, addressed Al Presidente de la Comision Esposicion, Secretaria de Club Industrial, Buenos Aires. 4. The charge to foreign exhibitors will be 5 dols. (1*l.* sterling) per square meter. 5. Articles intended for exhibition will be admitted from the 15th of June to the 15th of August, 1880. 6. No articles presented for exhibition can be removed until the close of the Exhibition. 7. All articles exhibited must figure under the name of the parties soliciting their admission, and any prizes awarded will be given in the same name. 8. Exhibitors may inscribe the names of the manufacturers or agents on the goods exhibited as well as their own. 9. All goods intended for the Exhibition will be admitted by the Customs free of duty, but must come expressly for the Exhibition, and as a guarantee that such is the case, each lot of goods must come accompanied by a certificate from the Argentine Consul at port of shipment. 10. All goods not reshipped after the close of the Exhibition must pay the customary duties.

We learn from the Argentine Consul General, No. 60 Wall St., New York, that foreigners can only compete in respect to exhibits of improved machinery.

Scientific Societies.

At recent meetings of scientific and professional societies in this city, officers for the ensuing year have been elected as follows:

New York Academy of Sciences: President, John S. Newberry; First Vice-President, Thomas Eggleston; Second Vice-President, B. N. Martin; Corresponding Secretary, A. R. Leeds; Recording Secretary, O. P. Hubbard; Treasurer, J. H. Hinton; Council, D. S. Martin, G. N. Lawrence, A. A. Julien, A. C. Post, W. P. Trowbridge, Louis Elsberg; Curators, B. G. Amend, C. F. Cox, B. B. Chamberlin, Charles A. Seeley, W. H. Leggett; Finance Committee, T. B. Coddington, Philip Schuyler, Thomas Bland.

American Ethnological Society: President, Alexander J. Cotheal; Vice-Presidents, Charles E. West, LL.D., and Charles C. Jones, Jr.; Corresponding Secretary, Charles Rau; Recording Secretary, T. Stafford Drowne, D.D.; Treasurer, Alexander J. Cotheal; Librarian, Henry T. Drowne; and Executive Committee, George H. Moore, LL.D., Asa Bird Gardner, LL.D., and Henry T. Drowne.

American Institute of Mining Engineers: President, Wm. P. Shinn, of St. Louis, Mo.; Vice-Presidents (in place of those whose term expires this month), James A. Burden, of New York; Dr. Charles B. Dudley, of Altoona, Penn.; and Persifer Frazer, Jr., of Philadelphia. Managers (in place of those retiring this month), James C. Bayles, of New York; W. S. Keyes, of San Francisco; and Percival Roberts, Jr., of Philadelphia. Treasurer, Theodore D. Rand, of Philadelphia; Secretary, Dr. Thos. M. Drown, of Easton, Pa.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

Vertical & Yacht Engines. T. P. Pemberton, 276 Water St., N. Y.

Brick Presses for Fire and Red Brick manufactured at 709 S. Fifth St., Phila., Pa. S. P. Miller & Son.

The great advantage of the genuine Asbestos Coverings for Steam Pipes, Boilers, etc., over any other forms of non-conducting coverings, aside from their superior effectiveness, is that they are manufactured in convenient form ready for use, and can be easily applied without the aid of skilled labor. The H. W. Johns M'f'g Co., 87 Maiden Lane, N. Y., are the sole manufacturers.

Having bought the Forsythe Scale Works here, we offer our present manufactory, with 25 H. P. engine and boiler, for sale. This property is well situated for manufacturing, only three blocks from depot. Will be sold low. Waukegan, Ill., is 35 miles north of Chicago. Full description sent on application. Powell & Douglas, M'f'rs Pumps and Windmills, Waukegan, Ill.

For Sale cheap.—Williams' Standard Switch Board and District Hook Bells for Telephone Exchange. Address Exchange, Burlington, Vermont.

Practical Founder or Machinist, with some capital, desirous of going West. Box 8, Helena, Montana T.

Wanted—A pair of Hoisting Engines, cylinders 6 x 9 or thereby; new or second-hand, in good condition. Carnegie & Co., Latimer, Pa.

For Sale.—A small Iron Planer. W. W. Oliver, Buffalo, N. Y.

Wanted—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

Spokes and Rims, white oak and hickory, best quality to any pattern, and Hammer Handles of best hickory. John Fits, Martinsburg, West Va.

Patent for Walter's Method of Carpeting Stairs, illustrated in this number, for sale cheap.

Wanted—Scrap Iron, car lots. Box 302, Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery address H. A. Crossley, Cleveland, Ohio.

For Iron Gas Pipe, see adv. on inside page.

Sidewheel Yacht Engines, boats drawing 6 to 10 in. water, in pairs. Ad. Y. & K., Owego, Tioga Co., N. Y.

Collection of Ornaments—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 126.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 125.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc., Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 110.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave., Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Steam Engine for sale very low. See advertisement on another page.

Portable Forges, $10. Roberts, 107 Liberty St., N. Y. For Mill Mach'y & Mill Furnishing, see illus. adv. p. 141.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 94.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Solomon's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

The Twiss Automatic Cut-off; also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

New Inventions examined and tested. Designs and improvements. Reports for investors. Recipes and information on all industrial processes. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Ice Machines selected. Information on all kinds. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Chase's Pipe Cutting & Threading Machine. Send for circular. Chase Machine Co., 120 Front St., New York.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 9 cents per pound. Fully warranted.

Cylinders, all sizes, bored out in present positions. L. B. Flanders Machine Works, Philadelphia, Pa.

For Wood-Working Machinery, see illus. adv. p. 156.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 62.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

The Horton Lathe Chucks; prices reduced 25 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$275 Horizontal Engine, 20 H. P. See page 156.

Emery Wheels of all kinds, and Machines at reduced prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 158.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds, strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Drop Hammers, Die Sinking Machines, Punching and Shearing Presses. Pratt & Whitney Co., Hartford, Ct.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 158.

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. Important, that users should have prices of these first class goods. Address Amer. Twist Drill Co., Woonsocket, R. I.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN ANTIQUARIAN. A Quarterly Journal devoted to Early American History, Ethnology, and Archæology. Edited by Rev. Stephen D. Peet. Chicago: Jameson & Morse. Vol. II., No. 2.

A very creditable and thoroughly scientific periodical, doing good work in a field of real importance.

THE ANTIQUARY. A Magazine devoted to the Study of the Past. Edited by Edward Walford, M.A. New York: J. W. Bouton. No. 1, Vol. I.

A thoroughly English magazine likely to delight the dilettante gatherer of antiquated trifles, devoted chiefly to historical and biographical matters pertaining to the British islands and the British people.

HOW TO LEARN SHORTHAND. By Arthur M. Baker. New York: S. R. Wells & Co. Paper, pp. 48.

Claims to be an improvement upon Taylor's system of stenography, and to be the simplest, most practical, and the best adapted system of shorthand for reporting. There are probably not more than twenty systems before the public that are better.

THE REFUTATION OF DARWINISM AND THE CONVERSE THEORY OF DEVELOPMENT. By T. Warren O'Neill. Philadelphia: J. B. Lippincott & Co.

Another illustration of the facility with which the theory of evolution can be overturned by those who have but a second hand knowledge (and little of that) of the facts of natural history. As a constructive theorist Mr. O'Neill is as fearless as he is in the work of destroying Darwinism; but we do not apprehend that naturalists will be greatly influenced by his views.

THE SUGAR BEET: INCLUDING A HISTORY OF THE BEET SUGAR INDUSTRY IN EUROPE. By Lewis C. Ware. Illustrated. Philadelphia: Henry Carey Baird & Co. 8vo, cloth, pp. 323. Price $4.

In addition to a detailed account of the varieties, qualities, cultivation, feeding value, etc., of the sugar beet as developed in Europe, this thoroughly practical treatise reviews at considerable length the history, present condition, and future prospects of the beet sugar industry in this country. The author is confident that before long the $80,000,000 annual tribute we pay to foreign countries for sugar will be kept at home, and that the sugar beet will be one of the chief means for enabling the people of the United States to produce all the sugar they require.

SIXTH QUARTERLY REPORT OF THE PENNSYLVANIA BOARD OF AGRICULTURE. Harrisburg: Lane S. Hart, State Printer.

Contains a report of the fall meeting of the Pennsylvania Board of Agriculture; reports of the past year's crops in comparison with the yield of the year before; the condition of growing crops and of farm stock; prices of farm produce, etc. Also a useful paper on the lung plague among cattle, and other information of use to Pennsylvania farmers.

THE MICROSCOPE IN MEDICINE. By Lionel S. Beale. Philadelphia: Lindsay & Blakiston. 8vo, pp. 530. Price $7.50.

This is the fourth edition of Professor Beale's well known treatise much enlarged. Most of the 500 illustrations have been drawn on wood by the author. The index, which contains over 2,000 references, fairly indicates the encyclopedic character of the work. It is somewhat remarkable that an edition for American use should not have contained some American names and addresses in the list of "microscope makers and others useful to microscopical observers."

THE COMPEND OF TAKIGRAPHY. By D. P. Lindsley. New York: D. Kimball. 12mo, paper, pp. 84.

Contains a summary of the principles of the simple style of takigraphy, a system of shorthand writing which deservedly ranks among the best.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) C. H. B. asks how to color glue. A. Use any of the soluble coal tar aniline dyes.

(2) E. S. asks: 1. Could you suggest a clear transparent and quickly drying varnish to preserve sphygmographic tracings on mica slides? A. Try the following: Gum juniper, 2 drachms 8 grains; gum frankincense, 1 drachm 10 grains; alcohol, 4 ounces. Filter through paper, and use the clear solutions. 2. Give a method by which the tracings could be transferred to a record book. A. We know of nothing better than a solar print.

(3) W. H. C. asks for the best acid or mixture for scouring and polishing copper. A. Solution of oxalic acid is commonly employed. Finish with whiting.

(4) C. R. writes: We are using the condensed water from exhaust steam in the boiler, and find that the grease in it makes the boiler foam. Would coal oil cut the grease and precipitate it so that we could blow it off? If not, what do you suggest? A. Try a small quantity of lime (caustic) and use the blow-out. Petroleum would be of little use.

(5) I. G. B. asks the name of the very bright star now to be seen near the horizon about due south. Please state all that will be of any interest. A. It is Sirius, the dog star. It is estimated that it gives us four times as much light as any other star visible in our latitude. It was for a long time supposed that Sirius had a companion, but it was not actually seen until February 1862, when the younger Mr. Clark, of the firm of Alvan Clark & Sons, the well known telescope makers, turning upon the star the eighteen inch glass then just completed for the Chicago Observatory, saw it. The satellite was discovered exactly in the predicted direction for that time, though the discoverer was not aware of this fact at the time.

(6) A. B. asks how to make emery belts for polishing spokes and other wood work. A. Take emery or sharp sand, spread it out on an iron plate heated to about 200° Fah. Apply to your straps or belts a rather thin coating of strong glue, then press it upon the heated emery or sand. Either leather or cotton webbing may be used for the belt.

(7) B. J. R. asks: How is carbon tracing or copying paper used for duplicating writing in pencil prepared? A. Rub into a suitable tissue a mixture of 4 parts of lard, 1 part of beeswax, and sufficient fine lamp black to give it a good color. The mixture should be warm and should not be applied in excess.

(8) J. H. P. asks where to find a full explanation of the theory that the *top* of a carriage wheel moves faster than the *bottom* when the carriage is moving. A. P. 394, Vol. 39, SCIENTIFIC AMERICAN.

(9) A. S. G. writes: Tell J. B. R. (No. 40, in No. 8) that I have had exactly the same experience as he, with four Watson cells, and, after charging it to every cause but the right one, removed the trouble by taking out the zincs and cleaning them with a stiff brush. I know this is contrary to directions, so much the worse for them.

(10) G. L. B. asks: What is the ratio of increase of resistance to that of speed in an object drawn through water? A. Nearly as the square of the velocity; at high velocities not quite so much, as the friction does not increase as the square of the velocity.

(11) W. J. P. writes: In your issue of February 28, in "Notes and Queries," No. 30, W. E. K. asks how to take a large coal oil spot out of a carpet. If it is of any value, I give you my experience. A kerosene lamp was carelessly dropped in the center of my parlor carpet. I drew the tacks nearest to it and drew out the paper under the spot and put in four thicknesses of newspaper. I then strewed over the spot common whiting to the depth of about half an inch, which I covered with a large paper to prevent tracking, etc. I left it a week, and then scraped up the whiting and raising the carpet a few inches from the floor I whipped it with a light switch to start the whiting, after which the spot was carefully swept. The oil had disappeared. This was four years ago, and no brighter spot is on the carpet than the place so treated.

(12) A. M. M. asks: 1. Will any kind of battery answer for silver or gold plating? If not, which is best? A. For light work the Smee battery is generally used. For heavy work use a carbon battery with electro-poin fluid in the porous cell. 2. How are solutions prepared for silver and gold plating? A. For silver bath, see p. 27 (3), Vol. 41, SCIENTIFIC AMERICAN, for gilding bath, see SUPPLEMENT, 160. 3. Can an electric lamp be operated with a battery? A. Yes, but not economically. It will take 50 cells of Bunsen battery to get a fair light. Better use a machine.

(13) J. G. S. asks: 1. What wire is it necessary to use between stations using the telephone described in No. 142, SCIENTIFIC AMERICAN SUPPLEMENT—that is, size; material, copper, or iron? A. Use No. 9 galvanized iron wire. 2. Is there any simpler calls than those described in SCIENTIFIC AMERICAN SUPPLEMENT in No. 163? A. A single stroke electric bell is the simplest call.

(14) P. T. writes: One party claims that anchor ice runs at night and whatever it touches it clings to. An opposite party claims that it does not run at night, but freezes on the bottom, and rises and runs when the sun warms the water sufficient to loosen from the bottom. Which is right? A. The latter.

(15) M. P. B. writes: 1. Suppose a perfectly round wheel to be rolling on a perfectly smooth surface, is the part of the wheel which touches the surface on which it is rolling at rest for the instant? A. Yes. 2. Does a cane gun come under the head of concealed weapons? If so why? A. Yes, because the weapon is concealed or disguised. 3. Does the piston rod of an engine come to rest at the end of each stroke before beginning the next? A. Yes.

(16) D. O. asks: 1. Is an engine with cylinder 2¼ inches diameter by 6 inches stroke with 100 lb. steam powerful enough to drive a propeller 20 inches diameter with 26 inches pitch? A. Yes. 2. What speed may I expect with boat 22 feet long and 5 feet wide, of good model? A. With plenty of boiler, 6 miles per hour.

(17) E. S. asks: 1. Is it necessary that a locomotive engine have two cylinders. If so, why? A. Yes, so that the engines can be started from any position. 2. What size engine used as a locomotive will it require to draw 12 cars weighing 800 a piece up a grade 4 feet per 100, that is, not allowing for slipping of the drive wheels on the rails? A. Your data is quite insufficient; you do not give size of driving wheels, pressure of steam, or speed.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

B.—Hematite and chalcopyrite.—W. M.—Not emery, but garnet in quartz.

COMMUNICATIONS RECEIVED.

On Experiments in Magnetism. By H. E. R.
On Activity on Jupiter's Disk. By I. S.
On Russian System of Shop Instruction. By W. F. D.
On a Curious Dust Formation. By B. N.
On Copper Nails. By J. A. B.
On the Force and Heat of Light. By C. B. M.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 10, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Button, stud, etc., I. N. Capron 224,396
Buttons, manufacture of horn, C. H. Dederer 224,399
Car brake, C. H. & W. E. Sparks 224,302
Car door, grain, J. H. Wickes 224,314
Car roof, J. C. Wands 224,496
Cars on tramways of railways, operating, I. Parker 224,267
Carpet sweeper, H. S. Wing 224,316
Carriage wheel guard, G. Bassett 224,367
Chair, E. T. Starr 224,609
Chandelier, extension, J. Kintz 224,462
Chenille, F. W. Heppelsberg 224,435
Churn, M. McAuly 224,345
Churn, G. R. Turner 224,466
Churn cover, E. C. Richardson 224,355
Churn motor, J. Henderson et al. 224,630
Coal and rock drill, S. Leonard 224,370
Cock, gauge, B. G. Felthousen 224,330
Coffee roaster, C. L. Cole 224,393
Combing fibrous substances, machinery for, Ducommun & Steinlen 224,605
Condenser for alcohol stills, J. H. Gladney 224,421
Cooking apparatus and dinner pail, Haptonstall & Banks 224,635
Cooking vessel, T. R. Timby 224,603
Corn and cotton scraper and cultivator, broom, W. L. Diets 224,632
Cornice, window, M. Murphey 224,466
Corset clasp, T. Frans 224,413
Cultivator riding attachment, H. Cole 224,390
Cultivator, spring tooth, H. Springer 224,607
Curtain fixture, Gaiman & Wurwell 224,297
Dam, dyke, etc., permeable, D. M. Currie 224,398
Dash moulding, T. E. Wraight 224,317
Desk, A. W. Koch 224,304
Disinfecting apparatus for water closets, etc., R. J. Mallett, Jr. (r) 9,066
Disinfecting compound, W. F. Wheeler 224,367
Door spring, J. H. Barber 224,377
Drill jar, R. McMullen (r) 9,072
Dust pan, C. F. Heath 224,304
Egg carrier and crate, W. Huey 224,625
Electric lighting apparatus, T. A. Edison 224,329
Electroplating frame, J. W. Rogers 224,678
Elevator, D. Frisbie 224,416
End gate, wagon, F. D. Fry 224,317
Excavating, hydraulic, R. Stone 224,309
Faucet, Redmond & White 224,354
Feather cleaner, D. Bumgardner 224,304
Feeding live stock, device for automatically, G. H. Daniels 224,276
Fence, I. H. Carman 224,267
Fence, Wintrode & Solomon 224,321
Fence, iron, Woodhill & O'Gorman 224,509
Fence post, W. Markle 224,454
Fence wire barbing machine, H. W. Putnam 224,351
Fences, warning plate for barbed wire, H. B. Scutt 224,602
Firearm, magazine, Wetmore & Bennett 224,366
Fire extinguisher, J. Hill 224,671
Fluted fabrics, mach. for creasing, J. H. Brown (r) 9,071
Fluting machine, C. A. Babcock 224,325
Folding boat, J. W. D. McDonald 224,346
Folding chair and pillow rest, comb'd, H. J. Buell 224,272
Galvanic battery, J. Doyle 224,404
Galvanic battery, W. Maynard 224,343
Galvanic battery cell, G. A. Converse 224,328
Gas, apparatus for the manufacture of, Attrill & Farmer 224,330
Gas for heating and illuminating purposes. Process and apparatus for manufacturing, Attrill & Farmer 224,206
Gas, process and apparatus for accelerating the distribution of, Du Motay & Stern 224,211
Glass mould, S. Hipkins, Jr. 224,633
Globe, G. Joslin 224,292
Gold and silver, machine for washing, sizing, and amalgamating, C. Dubms 224,408
Gold, apparatus for saving float, J. Wilkins 224,365
Grain separator, W. H. Parrish 224,470
Grinding and pulverizing apparatus, J. Rutherford 224,363
Hame, J. B. Place 224,474
Harrow, S. C. Cobb 224,273
Harrow tooth attachment, S. C. Cobb 224,274, 224,275
Harvester, corn, C. S. Willmoth 224,560
Hat brim edges, machine for heating, Lamson & King 224,220
Hay rack, W. P. Leland 224,451
Hides and skins, machine for shaving and fleshing, A. Gerard 224,286
Hitching bar for animals, J. W. Ricker 224,366
Hog ring, J. Peery 224,349
Hoisting device, S. B. Segur 224,483
Hoisting machine, J. G. Austin 224,322
Horse blanket and cover, I. B. Palmer 224,405
Horse power, endless chain, H. Y. Krause 224,445
Horseshoe, J. T. Cochran 224,276
Hose jacket, C. Crook 224,397
Hot air furnace, O. C. Stafford 224,608
Hub trimmer, G. N. Stearns 224,308
Hydrogen sulphide, making, W. E. A. Hartmann 224,435
Insulated coating, J. C. Chambers 224,394
Journal bearing, J. P. Colfelt 224,391
Knob attachment, B. Parker 224,349
Ladder, J. C. Moore 224,462
Ladder, extension, S. R. Adams 224,374
Lamp, G. J. Cook 224,394
Lamp, F. R. Kimball 224,442
Lamp, R. C. Lawton 224,449
Lamp burner, O. Merrill 224,460
Lamp, car, C. P. Howard 224,434
Lamp, hanging, J. Kintz 224,443
Lifting jack, W. C. Williams 224,490
Lock, C. W. Ade 224,373
Lock, J. Betjemann 224,380
Lock, F. Hasdenteufel 224,288
Locomotives, variable exhaust for, S. Rudd 224,357
Meal bin and sifter combined, C. B. Brown 224,326
Microphone, L. De Locht 224,630
Milk cooling and warming apparatus, A. H. Snyder 224,603
Millstone chop conveyer, J. H. Elms et al. 224,410
Millstone driver, W. Johnson 224,291
Millstone driver, H. N. Pomeroy 224,350
Moth and waterproofing compound, D. M. Lamb 224,296, 224,297
Nailing machine, A. Knowlton 224,300
Nails and spikes, machine for making hook-headed, L. Patterson 224,471
Nut lock, W. Broad 224,320
Nut lock, S. Larson 224,448
Oatmeal machine, W. Eberhard 224,363
Oil cloth, metal corner for, S. Hubbell 224,435
Organ action, F. A. Mehmel 224,457
Pantaloons protector, H. C. Wilson 224,329
Paper veneer, I. M. Clark 224,388
Peg float, J. Hancock 224,424
Pencil package, F. A. Mehling 224,458
Plaiting machine, J. F. Frantz 224,295
Planting machine, cotton and seed, W. B. Garoutte 224,418
Plow, E. G. Matthews 224,455
Pole, wagon, G. W. Doolittle 224,608
Portable engine, L. W. Hasselman 224,427
Post office box, J. Spruce 224,605
Pottery ware in kilns and ovens, apparatus for supporting, Leak & Edwards 224,450
Printing machine, chromatic, W. P. Kidder 224,440
Propeller, screw, D. G. Haskins 224,289
Pulping machine, wood, W. A. Deane 224,400
Pump, J. F. Gellatly 224,331
Pump brake, W. H. Cloud 224,389
Pumping attachment for hydrant hose, etc., B. C. Wilson 224,370
Punch, ticket, W. J. Brundred 224,271
Railway draw bar, T. C. Salveter 224,309
Railway rail joint, C. Reese 224,476
Railway switch, Meredith & Lyon 224,460
Railway switch, T. S. Taylor 224,310
Railway, wire cable, W. Eppelsheimer 224,364
Reclining chair, folding, J. Allen 224,319
Refrigerator, H. Druggen 224,363
Refrigerator, H. A. Doe, Jr. 224,362
Refrigerator, L. C. Sheldon 224,380
Rock drill bit, J. Fleming 224,412
Rocking chair platform, C. Knochel 224,340
Rolling mill, W. H. Glover 224,420
Rule, ten foot extension, W. J. Dorlekson 224,401
Saddle, harness, J. P. Zonne 224,502
Safe, burglar proof, H. Hebbaum 224,430
Safe, housekeeper's, E. H. Sturges 224,440
Sash fastener, W. Brenton 224,364
Sash holder, S. L. Sutton 224,362
Scale beam, J. H. Usher 224,494
Self-locking hook, J. R. Haines 224,423
Shade holder, J. A. Evarts 224,411
Sheet metal pan, A. Cox 224,396
Shingle cutting machine, P. H. Griswold 224,333
Shirt, J. F. Appell 224,365
Sifter, rotary coal, J. L. Koplin 224,341
Slate, hinged, H. L. Rowell 224,356
Sled propeller, Hitchiner & Heaton 224,432
Spark arrestor, J. E. Wiggin 224,497
Spinning frame, ring, T. Mayor 224,344
Spoke tenoning machine, T. Connor 224,393
Stamp, hand, G. K. Cooke 224,395
Steam boiler, S. L. Langdon 224,467
Steam boilers, superheater for, H. Schnabel (r) 9,069
Steam engine, portable, H. M. Sciple 224,481
Steam railway brake, O. B. Kendall 224,293
Steering apparatus for vessels, power, S. F. Tappan 224,364
Still for refining petroleum, J. D. Meigher 224,301
Store counter, H. H. Henderson 224,429
Stove, cooking, W. Murphy 224,464
Stove, cooking, J. A. Musselman 224,463
Stove foot fastener, D. Thomas 224,312
Stump extractor, W. Armstrong 224,376
Table, T. W. Morrison 224,302
Tap, dust, C. J. Waddell 224,495
Telephones, attachment for mechanically connecting hand, W. H. Sawyer 224,300
Tether, animal, S. D. Redman 224,353
Thill coupling, C. C. Egerton 224,409
Thill coupling, C. L. Goehring 224,420
Tobacco, etc., machine for wrapping, Gordon & Tait 224,332
Tobacco, process and apparatus for ordering leaf, J. C. Handley 224,290
Tobacco, process and machinery for manufacturing, S. W. Jones 224,489
Tooth crown and process of setting the same, artificial, C. M. Richmond 224,355
Toy frog, automatic, C. M. Alexander 224,375
Tube forming machine, G. W. Blake 224,382
Type clamp, W. J. Adams 224,322
Uterine supporter, C. P. Long 224,452
Valve, stop, G. W. Blake 224,381
Vapor burner, C. Woodhull 224,371
Wagon brake, J. A. Knetzer, Sr. 224,444
Wagon, dumping, H. Bailey (r) 9,067
Wagon jack, L. Miller 224,461
Wagon, rowing, C. L. French 224,415
Washer and nut, Peck & Knight 224,472
Washing machine, T. J. Austin 224,321
Watch key, Loveren & Bita 224,342
Water closet ventilator for railway cars and other conveyances, W. H. Smith 224,484
Water conductor, Irwin & Reber (r) 9,070
Water motor, T. Leininger 224,299
Water or wind mill, J. L. Nevers 224,467
Waterproofing compound, D. M. Lamb 224,295
Water wheel, E. B. Brooks 224,270
Well casings, cutter for removing, J. S. Munger 224,465
Wood, etc., machine for smoothing, W. Hassack 224,428
Wood polishing machine, G. Pelstring 224,473
Wooden box blanks, machine for cutting, W. Huey 224,437

DESIGNS.

Buckles, roller, J. E. Wightman 11,649
Carpet, T. J. Stearns 11,647
Coffin handles, W. M. Smith 11,652
Letters, D. C. Imboden 11,651
Monuments, J. Thayer 11,648
Oil cloth, C. T. & V. E. Meyer .... 11,644 to 11,646
Kuches, G. G. Bates 11,650

TRADE MARKS.

Canned oysters, L. McMurray & Co. 7,815
Cigars, cigarettes, and chewing and smoking tobacco, Sutro & Newmark 7,816, 7,817
Cotton sheetings and duck, L. Loomis 7,820
Eye wash, liquid, Benesia Chemical Company 7,818
Medicinal preparations, T. W. Woods 7,822
Rubber articles, hard, College Point Rubber Co. 7,814
Tobacco, fine cut chewing, Cutterill, Fenner & Co. 7,819
Whisky, A. Wood 7,821

English Patents Issued to Americans.

From February 6 to February 10, 1880, inclusive.

Axle boxes, railroad, T. A. Bissell, Detroit, Mich.
Bedsteads, O. Howe, Cambridge, Mass.
Bolt heading machine, J. B. & S. C. Clark, Plantsville, Conn.
Checks, etc., preventing alteration of, etc., J. Gurney, New York city.
Furnace, blast, J. F. Bennett, Port Carbon, Pa.
Gaskets, W. Wallace et al., Ansonia, Conn.
Harvesting machine, C. W. Marsh, Sycamore, Ill.
Photographic apparatus, T. H. Blair, Franklin, Mass.
Sewing machine driving and lubricating apparatus, B. Whitehill, New York city.
Slate and frame machine, E. J. Williams, Slatington, Pa.
Sound transmitting apparatus, T. Graydon, Cincinnati, Ohio.
Spring for railroad and other vehicles (2), J. S. Williams, Riverton, N. J.
Springs, machinery for bending and forming, C. F. Shoemaker, Cleveland, Ohio.
Telephonic apparatus, G. L. Anders et al., Everett, Mass.
Topophone, or apparatus for determining the direction of sound, A. M. Mayer, South Orange, N. J.
Torpedo boats, W. H. Mallory, Bridgeport, Conn.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. May also be had of ordered through booksellers and newsdealers everywhere. MUNN & CO., Publishers, 37 Park Row, New York.

To Business Men.

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is ten times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. If it is worth 25 cents per line to advertise in a paper of three thousand circulation, it is worth $4 per line to advertise in one of forty-eight thousand.

The circulation of the SCIENTIFIC AMERICAN is guaranteed to exceed FIFTY THOUSAND every week.

For advertising rates see top of first column of this page, or address

MUNN & CO., Publishers,
37 Park Row, New York.

THE FIRST SILO. A PAPER OF GREAT interest to agriculturists, detailing the mode of construction of the first "silo" built in America; describing the manner in which it was filled with fodder and how the ensilage appeared on the day of opening, and giving the results of the experiments, which were a success. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 210. Price 10 cents. To be had at this office and from all newsdealers.

HOULGRAVE'S GELATINE EMULSION. Additional details by the author in regard to preparing his celebrated Gelatine Emulsion for photographic purposes, with formulæ and full directions for using them; recipes for developers, and directions for developing. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 211. Price 10 cents. To be had at this office and from all newsdealers.

OBESITY: A FEW THOUGHTS ON ITS Nature and Treatment. By J. J. Mulheron, M.D. Obesity shown to be an abnormal condition, the result of a transgression of fixed physiological laws, and differing in this respect in no wise from disease in general; the dangers attendant upon it; method of treatment, embracing diet, exercise, and medication. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 218. Price 10 cents. To be had at this office and from all newsdealers.

OPTICS. BY F. A. HAMILTON. A very thorough and lucid explanation of the laws which govern the reflection and refraction of light, and a demonstration of the proper manner of applying these laws practically in illuminating dark localities, such as cellars and subterranean passages. Illustrated with 11 diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 210. Price 10 cents. To be had at this office and from all newsdealers.

SKIN DISEASES, AND SOME IMPORTant Topical Remedies used in their Treatment. By John V. Shoemaker, M.D. An important contribution to medical literature, pointing out the proper use of soaps in treating skin diseases, and what kinds and how they should be used; treating of numerous practical facts in regard to certain new preparations embraced under the name of "oleates," and urging the great importance of mechanical remedies, such as friction, compression, etc., in the external treatment of skin diseases, and showing how and when they should be applied. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 210. Price 10 cents. To be had at this office and from all newsdealers.

PATENTS

CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.
BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

A New and Important Book
ON
METAL MINING
JUST READY.

A Treatise on Metalliferous Minerals and Mining. By D. C. Davies, F.G.S., Mining Engineer, Examiner of Mines, Quarries, and Collieries. In one volume, 12mo, 430 pp. Illustrated by 148 engravings of Geological Formations, Mining Operations and Machinery, drawn from the practice of all parts of the world. *Price $5.00, by mail, free of postage.*

This book is designed to describe, in a concise and systematic manner, the conditions under which Metals and Metallic Ores are found in the different countries of the world.

CONTENTS.—Chapter I. Materials of which the Earth is made. II. Classification of the Deposits of Metalliferous Minerals. III. Metallic Contents of Lodes. IV. Second Class of Mineral Deposits. V. Gold. VI. Gold (continued). VII. Gold (continued). VIII. Gold (continued). IX. Gold (continued). X. Gold (continued). XI. Silver. XII. Silver (continued). XIII. Silver (continued). XIV. Copper. XV. Copper (continued). XVI. Copper (continued). XVII. Copper (continued). XVIII. Copper (continued). XIX. Copper (continued). XX. Tin. XXI. Tin (continued). XXII. Tin (continued). XXIII. Lead. XXIV. Lead (continued). XXV. Lead (continued). XXVI. Lead (continued). XXVII. Zinc. XXVIII. Iron. XXIX. Iron (continued). XXX. Iron (continued). XXXI. Various Metals. XXXII. On the Discovery and Proving of Mines. XXXIII. On the Working of Metalliferous Mines. XXXIV. Same subject continued. XXXV. Same subject continued. XXXVI. Same subject continued. XXXVII. Dressing of Metallic Ores. XXXVIII. Dressing of Metallic Ores (continued). XXXIX. Hydraulic Gold Mining. XL. Sundry Particulars of Work and Cost. XLI. General Considerations. Glossary.

We also publish:

DeKoninck.—Dietz.—A Practical Manual of Chemical Analysis and Assaying. As Applied to the Manufacture of Iron from its Ores, and to Cast Iron, Wrought Iron, and Steel, as found in Commerce. By L. L. De Koninck, E. Dietz and Robert Mallet. American Edition. Edited with Notes and an Appendix on Iron Ores, by A. A. Fesquet. 12mo. $2 50

Kobell.—Erni.—Mineralogy Simplified: A short method of Determining and Classifying Minerals, by means of simple Chemical Experiments in the Wet Way. From the German of F. Von Kobell, with an Introduction to Blowpipe Analysis, and other additions. By Henri Erni, M.D. 12mo. $2 50

Lieber.—Assayer's Guide; Or, Practical Directions to Assayers, Miners, and Smelters for the Tests and Assays, by Heat and by Wet Processes, for the Ores of all the Principal Metals, of Gold and Silver Coins and Alloys, and of Coal, etc. By Oscar M. Lieber. 12mo. $1 25

Normandy.—The Commercial Handbook of Chemical Analysis; or, Practical Instructions for the Determination of the Intrinsic or Commercial Value of Substances used in Manufactures, in Trades, and in the Arts. By A. Normandy. New Edition. By Henry M. Noad. 12mo. $5 00

Orton.—Underground Treasures: How and Where to Find Them. A Key for the Ready Determination of all the Useful Minerals within the United States. By James Orton, A.M. Illustrated, 12mo. . . . $1 50

Will.—Tables of Qualitative Chemical Analysis. With an Introductory Chapter on the Course of Analysis. By Heinrich Will. Edited by Charles F. Himes, Ph.D. 8vo. $1 50

Wöhler.—A Hand-Book of Mineral Analysis. By F. Wöhler, Professor of Chemistry in the University of Göttingen. Edited by Henry B. Nason. Illustrated. 12mo. $3 00

☞ The above or any of our Books sent by mail, free of postage, at the publication prices.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo, a Catalogue of Books on DYEING, CALICO PRINTING, WEAVING, COTTON and WOOLEN MANUFACTURE, 4to; Catalogue of a choice collection of PRACTICAL, SCIENTIFIC, and ECONOMIC BOOKS, 4to; List of Books on STEAM AND THE STEAM ENGINE, MECHANICS, MACHINERY, and ENGINEERING, 4to; List of Important Books on METALLURGY, METALS, STRENGTH OF MATERIALS, CHEMICAL ANALYSIS, ASSAYING, etc., 4to; two Catalogues of Books and Pamphlets on SOCIAL SCIENCE, POLITICAL ECONOMY, BANKS, POPULATION, PAUPERISM, and kindred subjects, sent free to any one who will forward his address.

HENRY CAREY BAIRD & CO.
Industrial Publishers, Booksellers, and Importers.
810 WALNUT STREET, PHILADELPHIA.

STEEL NAME STAMPS.
W. W. OLIVER, BUFFALO, N.Y.

INVENTORS, ATTENTION! WANTED.—The General Agency for the Pacific Coast of a number of staple articles of real merit. Satisfactory references. Address, giving full particulars, J. B. NILES, Box 250, Los Angeles, California.

Wanted in every Family.
Splendid combination. Step ladder, height, 5 feet; clothes bars, 20 feet; best ironing or skirt board, all neatly combined in one compact, durable article. Can be carried in one hand. Weighs only 18 lb. Customers say, "Well pleased." Send for sample. Price $3. Agents' terms a bonanza. Rights for sale. Address
J. H. MARTIN, Hartford, N. Y.

Say where you saw this.

Champion Combination and Youth's Companion Foot Lathes, Amateur Beam Engines & Boilers, Cylinder Saws and Stave Machines. Send stamp for price. Bragg's Cylinder Saw & Mach. Co. Taunton Mass.

48 Page Gilt Bound Floral Autograph Album, illustrated with Birds, Scrolls, Ferns & Flowers; also 6 select quotations all 15c.; including agent's card outfit (25 styles) 25c. (Stamps taken.) E. T. Hyde, West Haven, Ct.

INFORMATION WANTED CONCERNING prices and kinds of improved machinery for manufacture of brick, including mixing and preparing raw material, moulding, pressing, burning, etc. Address BRICKMAKER, Box 11, Sharon, Mercer Co., Pa.

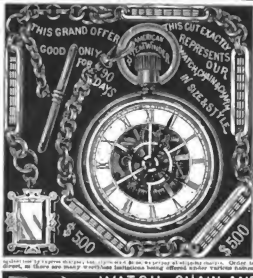
Crucible Steel Casting and Metal Co.,
LOUISVILLE, KY.
Manufacture castings of Pure Crucible Steel, equal in tensile strength and solidity to any made in the United States. It welds and works equal to the best Bar Steel. Orders filled promptly.

COE BRASS MFG. CO.
WOLCOTTVILLE CONN.
BRASS AND COPPER IN SHEETS. MATERIALS FOR METALLIC AMMUNITION A SPECIALTY. WIRE AND BLANKS.

WATCHES From $8 up; other goods in proportion. Beautiful Illustrated Catalogue **FREE**
E. NASON & CO., 111 Nassau Street, New York.

AN EASILY MADE SMALL, STRONG, AND CHEAP BOILER, for little Steamboats. By H. K. Stroud. With an engraving. This excellent little boiler is made of wrought iron mercury flasks, which may be readily obtained ready for use. Seven flasks are screwed together with ordinary gas fittings. This boiler has been used for a year past, with much success in the steam Sharpie yacht Magnolia. Length of boat 16 ft. 5 in.; beam, 4 ft. 6 in.; propeller, 16 inches diameter. For further description of boiler, boat, and engine with method of securing the propeller shaft in stern post, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 183. Price 10 cents. To be had at this office and of all newsdealers.


THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.



ONLY $5.00 AND WARRANTED 2 YEARS

THE BEAUTIFUL NEW-STYLE AMERICAN STEM-WINDING WATCH, which we offer to the readers of this paper, has many Novel and Wonderful Features, and is protected by Patents granted by the governments of the United States, Great Britain, Canada, Germany, Russia, France, Austria, Spain, Sweden, Denmark, and Belgium. Heretofore, a low-priced watch has been the pursuit of inconvenience, being of no value as a time-keeper, and a constant source of annoyance and expense to its owner. Our Watch is a **Marvel of Accuracy and Cheapness.** The inventor has spent years in simplifying, in all its parts, the **American Stem-Winding Watch**, and we are now, for the **First Time** in the world's history, able to offer a **Low-Priced, Perfectly Reliable Watch**, suitable for use on **Railroads and Steamers**, and all other places where accurate time is required.

The annexed cut shows the face of the Watch, giving the exact size and style. The face is covered with solid cut **crystal**, showing the handsome movements without the necessity of opening the case. The movements are of **American make**, known the world over for their **excellence and fine finish.** The case is made of beautiful, highly polished silvered nickel. It is thoroughly protected from the dirt and dust, to which a key-winding watch is daily exposed.

We know the **American Stem-Winding Watch** will meet with and grow in favor as its genuine merits and good qualities become known. There is now a growing demand for just such a Watch, for, more than ever before, are the acts of everybody governed by and performed on time, and we believe that the vast army of Professional Men, Clerks, Mechanics, Farmers and Laborers will appreciate a **Good Watch at a Cheap Price**, which they can rely upon for accurate time.

OUR GRAND OFFER! In order to introduce our goods in every neighborhood in the United States, we make the following unprecedented offer, viz.: On receipt of only $5.00, and **this advertisement, on or before the 15th day of May, 1880**, we will forward, all charges prepaid, and guarantee to reach you in good order,—one of our **American Stem-Winding Watches**, packed in a Handsome, Velvet-lined, Case. And, we further agree, to send with each Watch a Beautiful **Fire-Gold Chain and Onyx Charm** (as shown in cut). The chain is made from a composition of metals so closely resembling Gold that it is almost impossible for the best judges to distinguish the difference, even by a chemical test. It is the best substitute for gold ever discovered. We can only send out a certain number at prices named, and, to protect ourselves from jewelers and dealers ordering in quantities, we will insert this advertisement in this paper but **one time**, hence require you to cut it out and send to us, so that we may know you are entitled to the benefits of this offer. Under no circumstances will we send more than **one watch, chain, and charm** to any person sending us $5 or and this advertisement; but, after you receive one, if others are desired, we will furnish them at our regular wholesale prices. Many of our agents find ready sales for this combination at $25 00.

We will mail you a bundle of our Catalogues at the same time we send your goods, and feel sure you will be so well satisfied that you will oblige us by distributing them among your friends, and aid us by showing them your Watch. You can in this way assist us in selling other goods of **Standard Quality**, which we manufacture from **New and Original Designs**, and which we guarantee to give satisfaction.

Money can be sent by Registered Letter, Check, Money Order, or Draft on New York or Philadelphia, made payable to the Union Manufacturing Co. We will send the Watch C. O. D., with the privilege of examination, provided you send $2 or to guarantee against loss by express charges, but if you send $5.00, we prepay all shipping charges. Order before May 15th, as this agreement is void after that time. N. B.—Send to us direct, as there are many worthless imitations being offered under various names.

UNION MANUFACTURING CO., 136 S. Eighth St., Philadelphia, Pa.

CUT THIS OUT IT IS VALUABLE

WATCH, CHAIN AND CHARM ONLY $5.00

BUCKET PLUNGER STEAM PUMPS,
FOR EVERY DUTY.
VALLEY MACHINE CO.,
EASTHAMPTON, MASS.

NEW YORK BELTING AND PACKING COMP'Y.
The Oldest and Largest Manufacturers of the Original
SOLID VULCANITE

Emery Wheel.
EMERY WHEELS.
All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.
Address NEW YORK BELTING AND PACKING CO.,
JOHN H. CHEEVER, Treas. NEW YORK.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

Iron Gas Pipe For Sale at a Bargain.
2,000 ft. 1½ in., 12,000 ft. 2 in., 15,000 ft. 1¼ in., 20,000 ft. ¾ in., 4,000 ft. ½ in. Second-hand Good Pipe, Good Threads and Couplings. Also 100 Engines and Boilers, 4 to 20 horse, $100 to $800; Locomotive and Tender, $1,000.
ROBERT LOGAN, Oil City, Pa.

STEAM ENGINE, CHEAP.
For Sale, a 15 H. P. Steam Engine, of the Root pattern, in complete running order. Price $160. May be seen at JOHN HARTRICK & CO.'S, 7?8 Water St., New York.


DO YOUR OWN PRINTING.
$1 Self-Inking Printing Press, with complete outfit, $3.50. 9 larger sizes. Catalogue and reduced price list free.
H. HOOVER, Philadelphia, Pa.

Pond's Tools,
Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29 ST. NEW YORK CITY.


Forster's Rock & Ore Breaker and Combined Crusher and Pulverizer.
The simplest machine ever devised for the purpose.
Parties who have used it constantly for six years testify that it will do double the work of any other Crusher, with one-third the Power, and one-half the expense for keeping in repair. The smallest sizes can be run with Horse Power.
Address TOTTEN & CO., Pittsburgh, Pa.

Wood-Working Machinery,
Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

WANTED.—AGENTS FOR THE AUTOMATIC Shading Pen. Bookkeepers buy at sight. Send for circular and sample writing. J. W. STOAKES, Tribune Building, Chicago, Ill.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N.Y., who control the patent for Green's American Driven Well.

FOUR SIDED MOULDER, WITH OUT-side bearing. We manufacture 5 sizes of these moulders.

Also Endless Bed Planers, Mortisers and Borers, Tenoning Machines, Dovetailers, Blind Rabbeting Machines. Also a large variety of other wood working machines.
Address
LEVI HOUSTON, Montgomery, Pa.

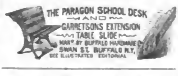
The Premium

Bucket.
DUC'S IMPROVED ELEVATOR BUCKET.
Made in sizes from 1½ to 20 inches. For use in FLOUR, GRAIN, MALT, ORES, COAL, BROKEN STONE, SAND, DRUGS, SPICES, PLASTER, etc., etc. These buckets are struck out from the *best charcoal iron*, and are almost indestructible. No corners to catch. No seams to burst. Run with great ease and fill *full every time.* No interior corners to clog up.
T. F. ROWLAND, Sole Manufacturer, Brooklyn, N. Y.

$10,000 INSURANCE FOR 35 Cts. ON LIFE & PROPERTY.
$10,000 will be paid to any person who can EXPLODE A LAMP fitted with our SAFETY ATTACHMENT. Mailed free for 35 cts. Four for $1. Agents Wanted, Male or Female.
S. S. NEWTON'S SAFETY LAMP CO., Binghamton, N. Y.
Salesroom, 13 West Broadway, N. Y.



ALAND'S
Silent Injector, Blower & Exhauster.
Apply to
S. ALAND,
Rome, Oneida Co., N. Y.



JOHN R. WHITLEY & CO.
European Representatives of American Houses with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E.C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

Grain Speculation!
Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., Chicago, Ill., for Circulars.

DRAWING INSTRUMENTS,
Swiss, German Silver, and Brass.
Sole Agents for
ALTENEDER'S INSTRUMENTS,
Drawing Paper, Paints, etc., etc. A new illustrated catalogue sent free by mail. WM. T. McALLISTER, 728 Chestnut St., Philadelphia, Pa.

FIRE BRICK TILE AND CLAY RETORTS ALL SHAPES. BORGNER & O'BRIEN, 23D ST. ABOVE RACE, PHILADELPHIA.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.

For breaking hard and brittle substances to any size. Endorsed by the leading Mining, Manufacturing, and Railroad corporations in the United States and Foreign Countries. First Premium wherever exhibited, and hundreds of testimonials of the highest character.

Indispensable for making best McAdam Roads, Ballasting of Railroads, Crushing the hardest Ores, Stone for Concrete, etc., etc. Prices greatly reduced.

The CHALLENGE was awarded the MEDAL OF SUPERIORITY by the Judges of the American Institute Fair, New York City, December, 1879, where it was exhibited in competition with our old form of Crusher. Address BLAKE CRUSHER CO., New Haven, Conn.

STEAM PUMPS.
HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.
THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.
WORTHINGTON STEAM PUMPS of all sizes and for all purposes.
Prices below those of any other steam pump in the market.
WATER METERS. OIL METERS.

THE HOLLY SYSTEM OF STEAM HEATING FOR CITIES AND VILLAGES. LOCKPORT N.Y.

WANTED.—RELIABLE PARTIES TO manufacture and sell on low royalty. Stamped Metallic Roof and Wall Tiles. Make the best and most beautiful roofs ever invented. Address C. G. VAN PAPPELENDAM, Charleston, Lee Co., Iowa.

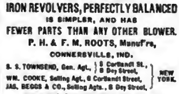
WANTED.—A SECOND-HAND RIDER Compression Pumping Engine; six inch; state condition, how long it has been in use, and lowest cash price delivered in Phila. Address P. O. Box 380, Phila. P. O.


BEECHER & PECK,
Successors of MILO PECK,
MANUFACTURERS OF
PECK'S PATENT DROP PRESS,
Regular sizes. Hammer from 30 to 2,000 lb. Special attention given to making of Drop Dies, Drop and Machine Forgings. New Haven, Conn.

STEAM PUMPS.
THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.

ROOTS' NEW IRON BLOWER.

POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED
IS SIMPLER, AND HAS
FEWER PARTS THAN ANY OTHER BLOWER.
P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 8 Dey Street,
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street, NEW YORK.
☞ SEND FOR PRICED CATALOGUE.

$5. COUNTY RIGHTS. $5.

The Eastlake Clothes Stick. Bauder's Pat., March 1879. Saves both time and labor, while the operator receives no scalds. Novel in construction, perfect in operation. Sells everywhere. Price 25 cts. Costs about 7 cts.—profits, 1,200 per cent. County rights—outside of Ohio—for sale (good for 16 years). Price only FIVE Dollars, including sample, prepaid. Refer to our P. M. and County Commissioners. Address
BAUDER & CO., Birmingham, Erie Co., Ohio.


SHEPARD'S CELEBRATED $60 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO.,
331, 333, 335, & 337 West Front Street, Cincinnati, Ohio.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators.
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - \$1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

FOR SALE CHEAP.
Two 6 foot SHEAVES, for transmission of power by wire rope. New—never used. For price, apply to W. T. CALL, Rock Island, Ill.

MICROSCOPES, OPERA GLASSES, SPY Glasses, Spectacles, Thermometers, Barometers, Compasses. R. & J. BECK, Manufacturing Opticians, Philadelphia, Pa. Send for ILLUSTRATED PRICED CATALOGUE.

H.W.JOHNS' ASBESTOS Boiler Coverings.

The Asbestos steam Pipe and Boiler Coverings are the most durable, effective, and economical non-conducting coverings in use. They can be easily applied by any one, at a cost of from 25 to 50 per cent. less than are usually charged for inferior covering s.
☞ Note the address, send for samples and be sure and get the genuine, which is manufactured only by

H. W. JOHNS M'F'G CO.,
87 Maiden Lane, New York,

Sole manufacturers of genuine Asbestos Liquid Paints, Roofing, etc.
☞ Descriptive Price Lists free by mail.

WATCHMAN'S IMPROVED

Time Detector, with safety Lock Attachment. Send for circular to E. IMHAEUSER, 212 Broadway, P. O. Box 2875, New York. Beware of buying infringing detectors.

Has More Good Points,
Does More and Better Work,
Takes Less Power,
Than any Hammer in the World.
BRADLEY & COMPANY,
SYRACUSE, N.Y.

1780 Centennial Industrial Exposition, 1880

NASHVILLE, TENNESSEE, Feb. 26, 1880.

We announce to the Exhibitors and Visitors of the United States that extensive and elaborate preparations are being made to celebrate NASHVILLE'S CENTENNIAL year with becoming ceremonies, civic and military, and the progress of a hundred years will be best illustrated by celebrating it with an exposition of all that tends to the happiness, prosperity, and welfare of our common country.

We therefore call the attention of Manufacturers, Artists, Scientists, Educators, and the progressive men of the country to this feature of the celebration, which will be opened to the public on Friday, April 23, 1880, at 7 o'clock P. M., and continue day and night, Sundays excepted, until the 24th day of May.

Applications for space will be received and registered from this date.

Articles received for exhibition until Thursday, April 22, 1880.

The buildings are new, commodious, and built expressly for this occasion.

The main line of shafting is 2 1-16 inches diameter, and will run 250 revolutions to the minute.

The Agricultural line of shafting, 1½ inches diameter, will be same speed as main one.

Ample power, no premiums offered, believing that proper advertising is worth more than premiums.

Favorable rates on articles for exhibition over all lines of railroads, and excursion rates for visitors and tourists.

Correspondence solicited from all parts of the Union.

Address DR. GEO. S. BLACKIE, Nashville, Tenn.

For Young or Old.

Do Your Own Printing.

\$3 Press for cards, envelopes, etc. 14 other sizes, \$4 to \$75. Type setting easy by printed instructions. Do your own printing and advertising. Money made fast in any place printing or running a paper. Catalogue of Presses, Type, Cards, etc., for 2 stamps. Kelsey & Co., Mnf'rs, Meriden, Conn.

Detroit Emery Wheel Co.

Best wheels for Iron and Metal Workers' use. Write to J. W. COLE, Manager for Pennsylvania, Lower Lake Regions, and North-west. Box 94, Columbus, Ohio; also, Box 125, Chicago, Ill.

N.B.—I do not offer a second grade of "low priced wheels," as my customers say our regular grades are the most economical in use.

BOILER COVERINGS.

Plastic Cement and Hair Felt, with or without the Patent **"AIR SPACE"** Method.

ASBESTOS MATERIALS,

Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John Street, and Foot of E. 9th Street, New York.

The New York Ice Machine Company,

21 COURTLANDT STREET. Room 54.

Low Pressure Binary Absorption System.

Advantages over other Machines.
Makes 25 per cent. more Ice. Uses only ¼ water of condensation. No Pressure at rest. Pressure in running 14 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

The J. L. Mott Iron Works,
88 and 90 BEEKMAN ST.,
Manufacturers of
DEMAREST'S PATENT
WATER CLOSETS.
Simple in construction, perfect in operation, thoroughly excluding all sewer gas, and cleanly in every way.

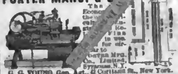
Gear Molding without Patterns

Scott's Gear Moulding Machines,

AIR COMPRESSORS & ROCK DRILLS.

DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
FOOT OF W. 13th ST., North River, NEW YORK.
ESTABLISHED 1841.

PORTER MANUF'G CO.



G. G. YOUNG, Gen. Agt., 42 Cortland St., New York.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
235 BROADWAY, NEW YORK.

The George Place Machinery Agency

Machinery of Every Description,
121 Chambers and 103 Reade Streets, New York.

THE WATSON PUMP FOR ... PUMPING ... PLUNGER & WELL ... SIMPLE EFFICIENT ... JAMES WATSON ... 1808 S. FRONT ST PHILA.

BOYLE ICE MACHINE CO.,
10 N. Jefferson St., Chicago, Ill.
The best Ice and Refrigerating Machines of all sizes and for all purposes guaranteed. Send for circular.

ORGAN **BEATTY** PIANO

New Organs 13 Stops, 3 set Golden Tongue Reeds, 2 Knee Swells, Walnut Case, warnt'd 6 years, Stool & Book \$98. New Pianos, \$143 to \$255. Newspaper sent Free. Address Daniel F. Beatty, Washington, New Jersey.

The Rodier Patent Single Iron Plane.

Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

THE PICTET
ARTIFICIAL ICE COMPANY, Limited.
Ice Machines to make from 20 pounds per hour to 50 tons per day, at 22 Courtlandt St., New York. P. O. Box 3083.

Lathes, Planers, Shapers
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

THE SKINNER PORTABLE & STATIONARY ENGINES & BOILERS & GOVERNORS
FIRST CLASS & ECONOMICAL. SKINNER & WOOD. ERIE, PA.
SEE ILLUSTRATED ADVERTISEMENT

POWER SHEARS.
STILES & PARKER PRESS CO., Middletown, Conn.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.

Horizontal Steam Engines,

For Economy, Durability, and Superior Design,
Complete in Every Respect,
ADDRESS
LAMBERTVILLE IRON WORKS,
LAMBERTVILLE, N. J.

PHOSPHOR-BRONZE,

ACKNOWLEDGED to be the BEST METAL for

BEARINGS, Cog Wheels,
HYDRAULIC SLIDES,
CYLINDERS, VALVES,
Pump Rods, BOLTS, ETC.

Pamphlets and particulars on application to

The Phosphor-Bronze Smelting Co., Limited,
2038 Washington Ave., Phila., Pa.

Sole Manufacturers of Phosphor-Bronze in the U. S.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

COLUMBIA BICYCLE.
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of The Bicycling World.
THE POPE M'F'G CO.,
89 Summer Street, Boston, Mass.

FRIEDMANN'S PATENT INJECTOR,
The best

BOILER FEEDER

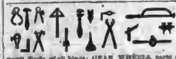
In the world.
Simple, Reliable, and Effective.
40,000 IN ACTUAL USE.
NATHAN & DREYFUS,
Sole Manufacturers, *NEW YORK.*
Send for Descriptive Catalogue.

WOOD SOLE SHOES.
The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send stamp for circular and price list.
CHAS. W. COPELAND,
122 Summer St., Boston, Mass.

Holly's Improved Water Works.

Direct Pumping Plan. Combines, with other advantages, over older systems, the following: 1. Secures by variable pressure a more reliable water supply for all purposes. 2. Less cost for construction. 3. Less cost for maintenance. 4. Less cost for daily supply by the use of Holly's Improved Pumping Machinery. 5. Affords the best fire protection in the world. 6. Largely reduces insurance risks and premiums. 7. Dispenses with fire engines in whole or in part. 8. Reduces fire department expenses. For information by descriptive pamphlet, or otherwise, address the
HOLLY MANUFACTURING CO., Lockport, N. Y.

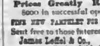
TELEPHONE Works 1 mile. Price \$4. Pat'd Circulars free. HOLCOMB & CO., Mallet Creek, Ohio.



Small Tools of all kinds; GEAR WHEELS, parts of MODELS, and materials of all kinds. Catalogues free. GOODNOW & WIGHTMAN, 176 Wash'n St., Boston, Mass.

Shafts, Pulleys, Hangers, Etc.

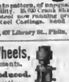
Full assortment in store for immediate delivery.
WM. SELLERS & CO.,
79 Liberty Street, New York.



Steel Castings

From ¼ to 15,000 lb. weight, true to pattern, of unequaled strength, toughness, and durability. 15,000 Crank Shafts and 10,000 Gear Wheels of this steel now running prove its superiority over all other Steel Castings. Send for circular and price list.
CHESTER STEEL CASTINGS CO., 407 Library St., Phila, Pa.

Leffel Water Wheels,



With recent improvements.
Prices Greatly Reduced.
8000 in successful operation.
FINE NEW PAMPHLET FOR 1879,
Sent free to those interested.
James Leffel & Co.,
Springfield, O.
110 Liberty St., N. Y. City.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of \$1.50 by mail, or \$1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought
STRUCTURAL IRON.
It is believed that, were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders, on application.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES
AND
AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL Co
SEND FOR PAMPHLET FITCHBURG MASS.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.

Orders respectfully solicited. H. SCHLARBAUM, Inventors' Modelmaker, 203 Broadway, New York.

BRASS AND COPPER TUBES
SEAMLESS & BRAZED
MERCHANT & Co. PHILADA

TO STEAM USERS:

Save Fuel and Money.

Obtain regular speed, and prevent explosion by using

PEERLESS DAMPER REGULATOR,

the greatest fuel-saving appliance ever invented. Adjustable to any pressure. In ordering mention pressure. Illus. catalogue sent on application. We set it up and guarantee performance. Price, \$75.00.

AMERICAN STEAM APPLIANCE CO.
SOLE MANUFACTURERS,
13 and 15 Park Row - - NEW YORK.

BROWN'S PAT. SPLIT PULLEYS
Shafts, Hangers,
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

1880. 1880. 1880.

The Scientific American

FOR 1880.

THIRTY-FIFTH YEAR.

VOLUME XLII. NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Third day of January, 1880, a new volume was commenced. It will continue to be the aim of the publishers to render the contents of the new volume as attractive and useful as any of its predecessors.

Only \$3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, \$1.60; three months, \$1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post-direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, \$4, gold, for SCIENTIFIC AMERICAN, 1 year; \$9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

(Entered at the Post Office of New York N. Y., as Second Class Matter.)

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 12. [NEW SERIES.] | NEW YORK, MARCH 20, 1880. | $3.20 per Annum. [POSTAGE PREPAID.]

THE MANUFACTURE OF SEWING MACHINES AND BICYCLES.—THE WEED SEWING MACHINE FACTORY.—[See page 181.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included	$3 20
One copy, six months, postage included	1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, MARCH 20, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 220.

For the Week ending March 20, 1880.

Price 10 cents. For sale by all newsdealers.

THE ST. GOTHARD RAILWAY TUNNEL.

The junction of the northern and the southern sections of the St. Gothard tunnel was accomplished on the morning of February 29, thus bringing to successful issue the boldest and most difficult engineering work of the kind hitherto attempted.

The St. Gothard group of mountains comprise that part of the Alpine range in South Central Switzerland, directly north of the valley of Lake Maggiore, and separating the railway system of Switzerland from that of Northern Italy.

The project of tunneling Mount St. Gothard was a necessary consequence of the tunnel through Mont Cenis. Until that time most of the traffic and travel between Italy and Switzerland—in other words, a large part of the overland commerce between England, Belgium, Northeastern France, Western and Central Germany, and Northern Europe generally, on the one hand, and Italy on the other, and the Levant as reached through the Italian ports—was carried on through Switzerland. The three great roads over the Swiss Alpine passes, the Simplon, the Splügen, and the St. Gothard, monopolized by far the larger part of this important trade. This monopoly was broken up when the Mont Cenis tunnel was completed in 1870, the bulk of the traffic and travel being thereby diverted through Western Italy, by way of France, to the inconvenience and loss of Northern and Central Europe.

Switzerland and Germany especially felt the need of restoring a more direct line of transit. The Simplon route was rejected because, like the Mont Cenis route, it would be directly tributary to France. The Splügen pass was less difficult than the St. Gothard, but the road leading to it must pass along the upper Rhine, in dangerous proximity to the Austrian frontier. The favorable geographical situation of the St. Gothard route, in the heart of Switzerland, more than offset, it was thought, its engineering difficulties, and it was therefore adopted. The entire length of the costly railway line, of which the St. Gothard tunnel forms a part, is 151 miles, 17 per cent of it being tunnels, and 1 per cent bridges and viaducts. The main tunnel is about 9¼ miles long. There are twelve other long tunnels, ranging between 1,106 and 2,027 yards, and aggregating nearly ten miles in length; five tunnels between 220 and 550 yards in length; and twenty-five tunnels between 110 and 220 yards long. In all, there are fifty-two of these subsidiary tunnels, having a total length of 16 miles. The line is also carried over sixty-four bridges and viaducts, the longest, at Cadenazzo, in Tessin, consisting of five spans of 55 yards each.

The main tunnel traverses Mt. St. Gothard between Goeschenen on the north side and Airolo on the south. The contract for its construction was awarded to M. Louis Favre, of Geneva, August 7, 1872. The work was begun at Airolo the following month, and at the other end in November. The time set for the completion of the great task was eight years—six months more than the time actually employed.

Airolo station is 3,757 feet above the level of the sea, and Goeschenen 3,639 feet. The tunnel runs straight between these two points, except for 158 yards at the Airolo end, where a curve connects the tunnel with the station. The tunnel has been constructed for two lines of way, 4 feet 8½ inches gauge, the contract calling for a cutting of horseshoe form, 19·68 feet high by 24·93 feet wide at the level of the sleepers, and 26·24 feet at the springing of the arch, 6½ feet above the sleepers. The arch is a complete semicircle of 4 meters radius. The sides are curved to a radius of 33·13 feet. Where the rock was solid the tunnel was cut to the exact section without masonry.

The line of the tunnel rises from both ends to a summit level 197 yards in length; the northern gradient, for 8,128 yards, rising at the rate of 1 in 172; the southern gradient, 1 in 1,000, for 7,970 yards.

Before the work was begun, Professor Fritsch made a careful study of the strata to be pierced, and expressed the opinion that the principal mass to be traversed consisted of gneiss rich in mica; mica schist, gneiss, and hornblende-schist. These, he believed, extended through the mountain in the form of a fan, and he figured the amount of each as follows:

	Meters.
Granite gneiss, more or less homogeneous	2,300
Gneiss, more or less schistose	450
Crystalline limestone and gray marble	350
Micaceous schist passing into gneiss	1,300
Gneiss rich in mica passing into mica schist	6,400
Mica schist with hornblende	1,600
Gneiss more or less schistose	270
Mica schist, with veins of quartz	800
Hornblende schist	1,250
Dolomite, gypsum, etc.	100

The nature of the rock met throughout went, in the main, to justify the Professor's prophecies. The material taken from the opposite ends differed widely. At the north end a layer of very hard rock was first met; hardly any water came from the roof, and but little timber was needed. At the southern extremity, on the contrary, the dominant rock was mica schist, with numerous fissures, through which water leaked into the tunnel in great quantities. At one time it rushed in at the rate of 420 gallons per minute, and brought with it masses of *débris*. Later on, when beds of clay were struck, it rushed in at the rate of 2,640 gallons per minute. One hundred and eighty yards in a spring was met, which delivered 1,000 gallons a minute, and stopped the work for several days. The leakage kept varying from time to time, and at that side always giving much trouble to the workmen.

The headings were about eight feet square, giving frontal areas of sixty-seven and a quarter square feet. For the first half year they were driven by hand; after that, mechanical perforators, operated by compressed air, were employed. Full descriptions of the various devices of this sort, adopted during the progress of the work, with much detailed information touching the methods of working, rates of speed, cost of excavation, and so on, will be found in the several volumes of the SCIENTIFIC AMERICAN SUPPLEMENT, with many illustrations of the machinery employed and of the general engineering features of the work.

For the most part the air for the rock drills and for ventilating the tunnels was compressed by water power. At the north end of the tunnel the river Reuss furnished an abundance of water with a fall of 385 feet. This was utilized by means of turbines. On the south side water was scanty, so that it became necessary to work under a fall of nearly 600 feet. The turbines operated 16 air compressors at each end of the tunnel, supplying air enough under a pressure of 8 atmospheres to work from 18 to 20 drills, and to thoroughly ventilate the tunnel. About 600 pounds of dynamite were used daily, and, latterly, as many as 4,000 men were employed.

Many changes were made in the apparatus employed during the progress of the work, and great improvements were introduced. The temperature of the air in the tunnel was found to be always higher than that without. It steadily increased as the excavation proceeded. On the first day it rose from 35° Fahr. to 58°, while the air outside remained at 34°. The average temperature further in was found to be over 70°, while the rock was also much warmer than the surrounding atmosphere. Large bell exhausters were erected at each end of the tunnel for the removal of atmospheric impurities, although artificial ventilation was not needed until the boring was 1,000 meters deep. About 5,000,000 cubic feet of compressed air were forced into the excavation each day from either end, and an exhauster, capable of extracting 16,500 cubic feet per minute, was provided at each.

The contract price for the work was $196.40 a foot, tunnel complete; the work to be done October 1, 1880. For every day beyond that time the contractor was to forfeit $1,000 for the first six months, and $2,000 for each day of the second half year; a year's delay forfeiting the contract and the $1,600,000 deposited by the contractor's friends as security. On the other hand, a premium of $1,000 a day was allowed for each day gained upon the contract time. Accordingly there is due the contractor's successors the snug little premium of $215,000 for the early completion of the work.

Unfortunately the original contractor, M. Favre, did not live to see the accomplishment of his heroic task. While showing the levels to a French engineer, Saturday morning, July 19, he suddenly complained of a cramp, called for a glass of water, and fell down dead from an affection of the heart.

The prospect of losing by the St. Gothard route a large part of the traffic which now passes through the Mt. Cenis tunnel, has driven the French to urge the subsidizing of a project for piercing a still greater tunnel on the Simplon route.

The proposed tunnel strikes the mountain at a lower level than was thought of when the St. Gothard tunnel was projected; and, although its length will be greater, the conditions are so favorable that no doubt is felt in regard to its possible execution. Competent geologists pronounce the rocks of the Simplon less hard than those of St. Gothard, and predict that the work will suffer less from the infiltration of water. There is, besides, abundance of water power at both ends of the tunnel; and from their lower altitude the works will be less liable to interruption by the severity of the winter cold.

The railway extending from Lausanne up the lower part of the Rhone Valley is without curves, while the gradient nowhere exceeds 1 in 100. At its exit on the southern side of the mountain, in the Diviera Valley, the gradient is somewhat stronger—13 in 1000. In fact, when the tunnel is completed, the highest point of the line between Paris and Milan will not be in the Simplon, but between Dijon and Lausanne.

The tunnel will be over 12 miles in length, as compared with the 9 1-3 miles of the St. Gothard, and the 7½ miles of the Mt. Cenis tunnels; and as it is estimated that a daily advance will be made of 9 to 10 meters in the boring, so that the completion of the work is promised in 6 or 7 years after it is fairly begun.

The superior rate of progress in the St. Gothard tunnel over that in the tunnel of Mt. Cenis (9 1-3 miles in 7½ years, against 7½ miles in 13 1-3 years) was due mainly to the great improvements made from time to time in the machinery and explosives employed. The projectors of the Simplon tunnel count on a continuance of such inventive progress.

THE PATENT BILL NOW BEFORE THE SENATE.

We have heretofore pointed out the disingenuousness of the proposed new law, "To regulate practice in suits brought to recover damages for infringement of patents," the injustice it would certainly work to all who have property in patents, its practical confiscation of vested rights in what are assumed to be matters of only small concern to the owners, and the fairly doubtful question of its constitutionality, if tried on a broad issue in the tribunal of last resort. There is little satisfaction, however, to be derived by the owners of patents from the latter consideration, although it ought, indeed, to furnish a leading argument for the de-

feat of the bill; but, should it once become law, there is little doubt that its provisions would be generally sustained by the lesser courts throughout the country, and it would be many years, and only after it had done about all the injury possible, before a final reversion might be obtained.

It has also been shown that the passage of the bill through the House was effected by a sort of *coup d'état* "in the interest of the Western farmers!"—and that no consideration of its provisions was had in that body; it did not come from the Committee on Patents, which has from time immemorial had charge of such matters, and was passed with a very light vote, under the assumption that it covered nothing of essential consequence. It did not matter that Congress had heretofore, for two or three years, given a great deal of attention to the question of the revision of the patent laws, and that the Senate had ably canvassed the whole ground before passing a bill which the House summarily rejected; all of this goes for nothing, and the House, taking not more than five minutes' time therefor, passes a bill whose practical effect would be even greater than that of the previous Senate bill, and which cannot fail, if it become law, to work an almost complete confiscation of the property of thousands of patentees.

The proposed law is undoubtedly in the interest, and is the immediate, though skillfully concealed work, of a powerful combination of monopolists. The influence of great moneyed interests in shaping legislation, national as well as state and municipal, has undoubtedly been on the increase of late years. The great corporations and combinations of capitalists which now exist have only lately attained their present gigantic proportions, and, though the manner in which they work to compass their ends is partially understood, the far reaching scope of their schemes is almost beyond ordinary comprehension. There are so many "wheels within wheels" in the complex machinery they employ, that it is always difficult, and often impossible, to decide whence the power is derived, and precisely what object is to be attained. The effort to put through the proposed new patent law, the dexterity with which it was managed in the House, and the plausible and "taking" reasons at once given to the public for the urgent necessity of such a measure, show the way in which this department of their work is attended to. To suppose that the real reason for the passage of the bill was the one given—that it was simply a measure for the "protection of farmers"—would be ridiculous. But to find out exactly who are the parties working so strenuously for the passage of this law, how they have attained their present measure of success, and how much a complete victory would be worth to them in dollars and cents, would be to discover a portion of their work which it is their main object to cover up. A large proportion of the users of patented devices would prefer to pay an equitable price for the value they in this way receive, and in this fact lies the primal strength of our patent system. Any persistent and determined effort, therefore, to confiscate the rights of patentees, cannot have a popular indorsement, and the intimation that "the farmers," whose benefits under our patent system have been so great, are the sponsors of this movement, is absurd on its face. This excuse, and this particular way of changing our patent laws, were not thought of until lately, although there has been, for a long time, a powerful interest working for such amendments as will make it more easy and safe to infringe upon the rights of patentees.

Among those who have most earnestly sought such changes, and who would be the greatest beneficiaries thereby, are the great railway corporations, the sop thrown to the "farmers" would be but a bagatelle to what they would gain, for the passage of such a bill as that now before the Senate would give them advantages whereby they might virtually confiscate thousands of patents involving details of construction and operation, in road bed, bridges, cars, locomotives, supplies, etc. Certain large manufacturers of the Eastern States have also been very zealous in this work, from the success of which they would reap substantial benefits in escaping payment of fees on many minor patents.

The danger will not be over until the bill is taken up in the Senate and *defeated*, or so amended as to make another vote upon it necessary in the House. In the latter case, we may be assured, it will not again go through on a stolen passage. Meantime, and until some permanent disposition is made of the matter, it behooves all patentees, and all who are interested in the maintenance of any rights heretofore supposed to have been "secured" to them by our patent laws, to see that the members of the Senate are individually furnished with as many personal protests as the threatened enactment of so unjust a law ought to bring out.

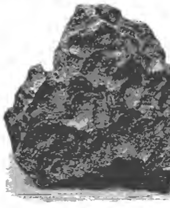
Imitation Stained Glass—A New Idea.

A few years ago stained glass windows were rare in this country, even in churches, except among the ambitious and costly of those of two or three denominations. Now ornamental windows are comparatively plenty, not only in churches, but in other public and private buildings, and would be more common in ordinary dwellings were the cost within the scope of ordinary purses.

The growing taste for this sort of color decoration cannot fail to be materially advanced by the cheap and very successful imitation of stained glass effects now coming into use. Thin sheets of silk paper are printed with brilliant oil colors, in varied artistic patterns; and when pasted upon common glass windows they produce all the brilliant effects of costly colored glass. The color sheets can be applied without skilled labor, and show a great advance in decorative effects over ordinary curtain shades or blinds. The invention has been patented, and we predict for the product a large demand. The address of the manufacturer may be found in our advertising columns.

THE NEW METEORITE.

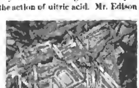
In our issue of March 6, we gave a brief account of a new meteorite, discovered near Chulafinne, Ala., by Mr. John F. Watson, and now in the possession of Mr. Edison's expert mineralogist, Mr. W. E. Hidden, of Newark, N. J.



Meteorite from Chulafinne, Ala.

We now present our readers with a side view of this interesting object, and give a representation of the Widmannstaettian figures which it exhibits. Upon analysis of the meteorite, its constituents are found to be approximately as follows: Iron, 92 per cent; nickel, 7 per cent; phosphorus, about the same as ordinary steel; and of copper and carbon only a trace. It is about as hard as copper, and exhibits about the same tenacity under the cutting tool.

This in common with other metallic aerolites is very heterogeneous, as indicated by the marked figures developed on the polished faces by the action of nitric acid. Mr. Edison suggests that "These lines are without doubt a map of the streets of the New Jerusalem."



Widmannstaettian Figures on the Chulafinne, Ala., Meteorite.

Meteorites of this size (31 lb.) are not extremely rare, and they have been found of all sizes, weighing from a few ounces to 25 tons. It is now generally conceded that these strange bodies fill the spaces between the orbits of the planets and swing around the sun like so many miniature worlds, until by unexplained causes they are brought within the attractive influence of the larger planets, when they gravitate toward the superior body.

Kepler's idea that there were more small bodies flying about in space than there are fishes in the ocean, seems to find support in modern discoveries.

The Great Iowa Meteorite.

This great meteorite, which fell in Iowa the early part of last year, is thus described by Professor Thompson, of the Minnesota State University, in a recent astronomical essay: May 10, 1879, was a bright, clear, cloudless day. At 5 o'clock in the afternoon, in full sunshine, this meteorite passed through the air, exploded, and fell in the town of Erterville, Emmet County, Iowa, about ten or twelve miles below the southern boundary of Jackson County, Minn., in latitude 43° 30′ north, longitude 94° 50′ west from Greenwich. The path it followed marked a course from northwest to southwest, and was seen for a distance of several hundred miles. Its appearance in the heavens was that of a huge globe of fire, attended by a fiery cloud. The people who saw it were greatly alarmed; not more at the flying ball of fire which seemed so near to them, than at the terrific explosions immediately above them; those who did not see it thought an earthquake had occurred, and were in great terror. The noise accompanying its flight is described as rumbling, cracking, crashing, similar to that produced by a train of cars crossing a long bridge; then came a very loud report, followed immediately by two distinct reports in quick succession, though not so explosive or loud as the first. It struck the ground in separate masses, together with smaller fragments scattered over an area of three or four miles. There were two large pieces which fell about two miles apart.

The largest mass, weighing 470 pounds, now at Keokuk, Iowa, penetrated a hard blue clay soil, to the depth of twelve feet. Another mass, weighing 170 pounds, now at the State University, fell on a dry grassy knoll, and was buried to the depth of 5½ feet. A few rods from the largest mass was found a fragment weighing 30 pounds, and a schoolboy picked up a specimen weighing three pounds. The form of all the pieces is like that of rudely detached masses from a quarry, or ejected from the mouth of a volcano. The mass in the museum of the university has an irregular rhomboidal outline, about 15 by 18 inches, of an average thickness of 6 inches, and when first obtained was covered, as most meteorites are, with a black shining coat or crust. The largest mass is not so regular in its formation. It is more ragged and bristles with points of nickeliferous iron. Professor Heinrich, of the Iowa State University, pronounced it the more valuable of the two large masses; but a full analysis will probably determine them to be one and the same. While the nickeliferous iron seemed more abundant in the largest, the crystalline formations are far more numerous in the smaller.

THE FIRST STEP IN INVENTION.

A correspondent, who has had some experience as an inventor, suggests that the SCIENTIFIC AMERICAN should regularly set apart a portion of its space for the outlining of inventions needed. This for the purpose of setting inventors "on the right track," and so laying out their work, that they may "go immediately at the thing wanted."

To a considerable extent the SCIENTIFIC AMERICAN has always made a practice of suggesting, whenever it could, opportunities for invention; and not unfrequently such suggestions have been successfully worked out and patented by wide-awake readers. Further opportunities of the sort will be gladly taken advantage of; and pleasure will also be taken in presenting the suggestions of any who clearly perceive the need of and opportunity for specific improvements in any art or manufacture, but are unable, for lack of time, means, or inventive capacity, to undertake to work out the needed invention.

Such suggestions, however, our correspondent will readily understand, are not likely to be numerous. Our countrymen are by habit as well as by nature, inventors; and when one sees a chance to better any process or product he is very sure to keep his knowledge to himself for future developments. It is mainly in connection with inventions requiring a large outlay of time, labor, or money, or all three, that men voluntarily give away ideas of value. However original and valuable, such ideas are not apt to be salable; while only the more courageous and forehanded among inventors dare attempt to develop them materially.

Opportunities for working out such costly and complicated inventions are obviously of little use to the class of inventors which our correspondent has in mind. What he wants is specific information touching this, that, or the other clearly felt deficiency in the means or methods of one or other of the arts, deficiencies which the would-be inventor could supply if he only knew what was wanted.

Such deficiencies are doubtless infinite in variety and number; but, for the most part, it is the business of the inventor to discover them, as well as to invent the remedy; and, in most cases, his acuteness is chiefly manifested in detecting the opportunity for a useful invention. The arts are full of improvable means and methods, and of openings for entirely novel processes. As a rule, it is the inventor of the future who will first detect where the needed improvements and substitutions should fall; and in this his genius will be chiefly displayed. The development of the inventions will be a secondary and comparatively simple work.

Accordingly, the faculty which the young inventor should cultivate most sedulously is the faculty of critical observation. He must learn to look upon everything in two aspects—first, to see exactly how it appears, how it was produced, and how it works; second, to see how its appearance, its working, or the manner of its production can be improved, simplified, and cheapened, or its uses extended; or whether something entirely different would not answer the purpose better. With the cultivation of this faculty the inventor's difficulties arise not from the lack of opportunities to invent, but from their multiplicity, and the need of restricting his thoughts and constructive labors to such novelties as are likely to be profitable.

In short, the young would-be inventor must begin further back even than Mrs. Glasse advised in her famous receipt for cooking the hare. He must not merely "catch the hare," but he first must learn how to catch hares and where they are likely to hide. After that the catching and cooking are easy.

THE telephone has been found by Herr Niemöller (*Wied. Ann.*) capable of determining very quickly and accurately the resistance of liquids. It is substituted for the galvanometer in a galvanic bridge, and an induction current is used; then, if the resistances compared are a large liquid resistance on the one hand, and a Siemens resistance box on the other, so that the electro-dynamic constants of the branches are very small; if, further, a German silver or platinum wire be used as measuring wire, it is found that in the position where the galvanometer shows no deflection, the tone in the telephone has a well-marked minimum of intensity. Supposing the liquid resistance has 2,000 units, a variation of it, even 4 units, reveals itself in a displacement of the minimum position.

AT the present time there is annually manufactured on the Mississippi River and its tributaries about 1,500,000,000 feet of white pine lumber, with its proportionate accompaniment of shingles, laths, and pickets. This is mostly consumed west of the river, and finds its way to Texas, Kansas, and Nebraska, and even to Colorado. St. Louis receives more lumber annually than any other point on the river, but after deducting the amount required for home consumption, Hannibal distributes more for foreign consumption than St. Louis.

Improved Surveying Instruments.

Mr. T. A. Matsdaira, C.E., a native of Japan, now of this city, is the author of several improvements as above. One of his instruments consists of a steel plate, upon which a bar graduated to fine divisions upon a scale of ten is fastened. At one end, so arranged as to slide upon this bar to any position, is a semicircular plate, with its circumference divided into degrees, minutes, and seconds. At the other end is a similar plate, a quadrant in form. At the center of these a movable bar is arranged to turn like a pointer and indicate the angle. Each is graduated to the same scale as the first bar. To find the required element of a triangle, it is only necessary to revolve the bar on the semicircular plate if the angle is obtuse, and upon the quadrant if it is acute, until the proper angle is indicated. With the other bar the given side is placed so that a triangle similar to the one to be solved is shown, and then the required angle can be read off from the plate. This is applicable whether one side and the adjacent angles, or one angle and the adjacent sides, or one angle and the opposite sides of a triangle are given. The result is obtained at a glance and in a few seconds, while the use of common trigonometrical calculations by sines and cosines involves the use of tables and takes much time. If the instrument is made with the accuracy attainable now in the construction of scientific apparatus, the result, the inventor claims, will be correct.

DISTANCE FINDER.

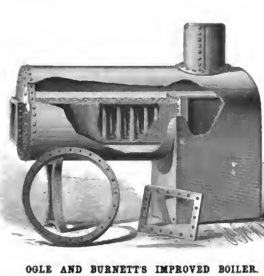
The same inventor makes an instrument for finding distances, which consists of a finely graduated brass or steel plate, two feet in length. It has a slot in the center and a movable support, to which a telescope is attached, which may be firmly fixed by a thumb screw. If, for instance, the distance of an object across a lake is sought, the instrument, which has five spirit levels to secure perfect accuracy, is placed in position, and the telescope is sighted upon the object and firmly attached to the support. It is then moved in the slot two feet to the other end of the plate, and another object is now noted through it. With this object in mind, the telescope is moved back to its first position, and turned until this second object is seen through it. The variation from the line of its first direction gives an angle of a triangle, at the other two angles of which are the two objects. By means of the first mentioned instrument the second angle and sides of the triangle are measured, and hence the distance of the first object is secured.

Another device for finding the distance of an object in a different way is also described by Mr. Matsdaira. The plate, two feet in length, has a fixed telescope at one end. At the other end, upon the arc of a circle, whose sections are four feet, another telescope moves, and has a pointer, which directs to a graduated scale at a tangent to the arc. When the two telescopes are both directed to the distant object the pointer indicates a certain number on the scale, which is divided down to $\frac{1}{50}$ of an inch. A table accurately prepared shows to what distance these numbers refer, and by looking on it the distance is ascertained.

IMPROVEMENT IN BOILERS.

The accompanying engraving represents an improved boiler recently patented by Messrs. J. D. Ogle and R. A. Burnett, of Washington Court House, Fayette county, O. The boiler is constructed with a view to a perfect and natural circulation of water, and is arranged so that all of the tubes, together with the tube sheets, may be easily removed from the boiler shell for cleaning or repairs. The flues or tubes are arranged vertically in a rectangular flue box, provided with a rectangular flange, which is bolted to a corresponding collar surrounding an opening in the rear wall of the fire box. The rear end of the flue box is riveted to the back head of the boiler, and the latter is secured to an internal flange in the boiler shell by bolts. The joints at the ends of the flue box are very strong, and capable of withstanding any strain that can be brought to bear upon them. The flame, smoke, and products of combustion pass through the flue box and around the flues, effecting a rapid generation of steam. The circulation of the water and steam in the vertical tubes is natural and perfect.

When occasion requires the removal of the tubes for cleaning or any other purpose, the bolts are removed from the rear head of the boiler and from the rectangular flange surrounding the forward end of the flue box, when the flue box, with the entire series of tubes, may be withdrawn from the boiler shell. In cases of boilers carrying a very high pressure, the flue box may be strengthened by stay bolts in the usual way. The advantages of this style of boiler will be apparent to any one familiar with the subject of steam generation.



OGLE AND BURNETT'S IMPROVED BOILER.

Tobacco Chewers not Wanted.

It is a well known fact that tobacco juice contains nicotine acid, a sort of tannate, very refractory in dyeing. The *Textile Colorist* says: It has just been discovered in Europe that stains and imperfections, unaccounted for so far, on various goods submitted to careful dyeing, were caused by the salivation of chewing workmen, especially weavers. Any moisture containing tobacco extract falling upon tissues of mixed materials, such as wool and cotton, notably in raised goods, as velvet, plush, blankets, etc., will create spots deeper in shade than the ground color, as if acted on by a stronger mordant. Manufacturers have been obliged to apply on an extra tannin mordant and redye many pieces of goods on account of this defect. Strict regulations against this ill use of tobacco salivation have been enacted in several establishments as a remedy for this curious inconvenience.

NEW SOLDERING TOOL.

The annexed engraving represents a modification of the ordinary soldering iron, intended to be used in capping or

PAINTER'S SOLDERING TOOL.

sealing provision cans. It facilitates the operation of soldering, and dispenses with the use of revolving tables and the complicated mechanism usually employed for the purpose. The invention consists in a can soldering tool, having a soldering edge curved to conform to the groove in the can cover designed to receive the solder, and a handle located at one side of the axis of the tool, so that while the rotation of the tool is dependent upon a rotary motion of the handle about the vertical axis of the can, its working edge is guided by the groove in the top of the can, to which it conforms. This invention was recently patented by Mr. William Painter, of Baltimore, Md.

Malleable Bronze.

Drozier claims to have discovered a simple method of rendering bronze as malleable as copper, iron, etc. This consists in the addition of a very little mercury—½ to 2 per cent. It seems to act mechanically rather than chemically. The mercury may be combined with one of the metals of which bronze is made, before they are combined, by pouring it into the melted metal and stirring well, or it may be put into the melted copper along with tin, or just after the latter has been added, or an amalgam of tin is stirred into the melted copper.

MECHANICAL INVENTIONS.

Mr. James J. Dubois, of Springtown, N. Y., has patented an improvement in wagon running gear, the object of which is to furnish wagon reaches constructed so that they may be screwed into the rear axle and the head block, and may be guarded from being worn by the forward wheels in cramping the wagon.

An improved ore feeder for stamp mills has been patented by Mr. Isaac B. Hammond, of Deadwood, Dakota Territory. The object of this invention is to furnish an improved machine, so constructed as to feed the ore to the mortars as it is required, automatically. It may be adjusted to feed more or less ore, as required.

Mr. Wade P. Wood, of Leon, Iowa, has patented a novel automatic brake for wagons. This invention is an improvement on the brake for which letters patent No. 206,063 were granted to the same inventor July 16, 1878. The improvements render it more satisfactory in use and more reliable in operation.

Mr. William Huey, of Cambridge, Md., has patented a machine for cutting blanks from a block of wood and simultaneously grooving it preparatory to bending it into form for making the rectangular sides of a box. The invention consists in the arrangement of a stationary horizontal knife bolted strongly to a bed frame, so that it cannot bend when under strain; an adjustable gauge plate with groove cutters arranged just in front of the knife and enough below its edge to give the proper thickness of blank, together with a reciprocating block carrier.

Mr. James A. Knetzer, Sr., of Fillmore, Ind., has patented an improvement in the class of wagon brakes in which the sliding brake bar is adjusted by a rock shaft hung on the rear axle, and having on its inner end an arm from which a rod extends forward to the brake bar. The improvement pertains to the construction of the lever which operates the rock shaft, and the construction and arrangement of the device which connects them.

A firm and easily applied device for fastening handles to axes and other tools, has been patented by Mr. Andy E. Tangen, of Bismarck, Dakota Ter. It consists in fastening the handle in the eye of the ax or tool by means of spring straps adapted to clasp the ends of the handle inserted in the eye, and a bolt inserted into the eye from the end opposite the handle, so as to engage the spring straps.

Mr. John Houck, of Tobyhanna Mills, Pa., has patented improvements in feeding mechanism for tubular cutterheads used for turning broom handles, curtain rollers, umbrella handles, and other wooden articles of cylindrical form. Such machines have heretofore been fitted with feed rollers fixed at the front and back of the hollow mandrel to carry the sticks through, and in case of the sticks breaking, or when for any reason access was required to the mandrel, considerable time and labor were involved, as the rollers or the mandrel had to be removed from their bearings. The object of this invention is to fit the feed rollers so that access may be had to the cutter readily without disconnection of the parts.

A combined rule, square, and gauge for carpenter's use in framing, has been patented by Mr. Mahlon B. Cornell, of Philadelphia, Pa. The object of the invention is to furnish an implement adapted for carrying out all the purposes for which the ordinary square is used with greater facility, convenience, and accuracy.

Mr. Lucius S. Edleblute, of Cincinnati, O., has patented an improvement in the class of metal wheel hubs in which the spoke tenons or butts are clamped between flanged collars, one of which is adjustable on the axle box to adapt it for convenient adjustment or removal. By the peculiar construction and arrangement of parts the inventor forms a very firm, strong, and durable hub, whose parts may be readily put together or taken apart, and which is adapted to carry a comparatively large supply of lubricant.

An improved vehicle axle, patented by Mr. James Conniff, of Oconto, Wis., consists of an axle made of cast iron in a cylindrical form, and divided off at each end into compartments, in which are placed rollers in a circle, so as to form a bearing for the spindles which are inserted in the ends of the axle. The spindles are held in the axle by collars, which rest in one of the compartments between balls, which hold them steadily and prevent endwise motion without producing much friction.

Mr. Jacob Mollet, of Liberty, Mo., has patented an improved vise for holding saws while being filed, which is simple, convenient, and so constructed that the whole of one side of a saw can be filed without moving the saw. It may be used for holding hand saws, crosscut saws, and circular saws with equal facility.

Coffee in Typhoid Fever.

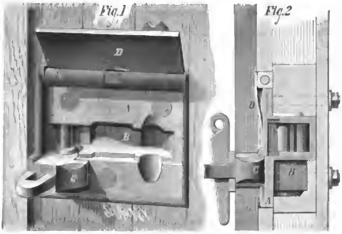
Dr. Guillasse, of the French Navy, reports that, in the early stages of the disease, coffee is almost a specific against typhoid fever. He gives to adults two or three tablespoonfuls of strong black coffee every two hours, alternating with one or two teaspoonfuls of claret or Burgundy wine. The beneficial effect is immediate. A little lemonade or citrate of magnesia should be given daily, and after a while quinine.

NEW CAR DOOR FASTENER.

We illustrate herewith a novel and effective car door fastener, patented by Messrs. William H. Buser and Burrell L. Shaw, of Denison, Texas. It is designed to afford a positive means of fastening car doors and, at the same time, to dispense with the cleat which is commonly used for stopping the door and which is so damaging to the side of the car.

An iron box, A, secured to the side of the car, has a recess, B, capable of receiving the staple block, C, which is pivoted on a vertical rod extending through the box. The recess, B, has a vertical branch into which the pivoted end of the staple block, C, may drop when the block is swung around at right angles with the face of the box, A, and when in this position it acts as a rigid stop for the door. It has a staple formed on its outer end to receive a hasp attached to the door and a lock or pin for securing the hasp. When the fastener is not in use the staple block, C, is raised up and turned upon its pivot until it is wholly within the recess, B, when the door, D, is closed, making all flush with the side of the car. The door is also closed when the fastener is in use, excluding dirt, snow, or ice, from the recess, B.

This fastening is very strong and well calculated to withstand the rough usage to which it must be submitted.



BUSER & SHAW'S CAR DOOR FASTENER.

SPEAKING PICTURE BOOK.

The engraving represents a novel toy recently patented in

BRAND'S SPEAKING PICTURE BOOK.

this country by Mr. Theodor Brand, of Sonneberg, Germany.

The invention consists of a device combining, in book form, pictures of animals and human beings, and mechanism for producing sounds in imitation of the voices of the beings represented.

The book contains a number of picture sheets, having on the reverse side the text referring to the picture on the preceding page. A part of the text page is shown in the engraving with the title, The Rooster, referring to the opposite page.

A portion of the book is broken away to show the mechanism beneath, which consists of bellows and whistles of well known construction for imitating different voices. The bellows are operated by the strings which project through the edge of the book, and are provided with buttons for convenience in operating the toy. By pulling the particular button belonging to the picture being exhibited, a sound is produced which imitates the voice of the subject represented.

ENGINEERING INVENTIONS.

Messrs. John Boyd, of Baltimore, Md., and Roy O. Crowley, of New York city, have patented an electrical water indicator for steam boilers, by means of which changes in the height of the water in a steam boiler may operate an electro magnetic apparatus to open and close the feed water pipe of a steam boiler, to admit and shut off the feed water automatically, as required, and to sound an alarm.

Mr. Eli Shafer, of Sigourney, Iowa, has patented an improved car coupling, consisting of an open mouthed drawhead, within which is a flat headed drawbar encircled by a strong spiral spring to force it outward. In the face of the head of the drawbar there is a transverse rectangular groove, within which the flattened end of the link is placed and held by a metallic block. The coupling has other novel features which cannot be explained without engravings.

An improved rotary engine, patented by Mr. James A. Adams, of Lampasas, Texas, consists, essentially, of a wheel provided with radially sliding pistons, and revolving within a fixed circumferential steam chest, and having fixed on its axle an eccentric and spring that operate to throw the pistons or floats outward to receive the pressure of the steam.

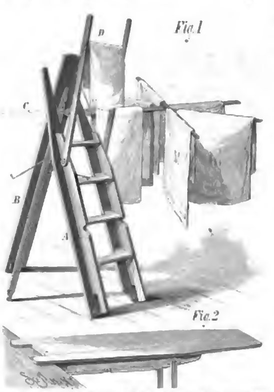
An improved car coupling has been patented by Mr. Horace E. Henwood, of Hamilton, Ontario, Canada. This invention is an improvement upon the automatic car coupling, forming the subject of United States letters patent No. 148,014; and it consists in a novel construction and arrangement of parts which cannot be explained without engravings.

Messrs. James P. Meredith and John S. Lyon, of Augusta, Ga., have patented an improved railway safety switch, in which the continuity of the main line is not broken and the use of frogs is dispensed with. The invention consists in the novel arrangement of jointed leading tongues, a lap rail section for crossing the main track, and movable guard rails, all connected so as to be operated at will, or by the wheels of the locomotive in passing over the track.

IRONING TABLE, CLOTHES DRIER, AND STEP LADDER.

The annexed engraving shows one of those novel combinations that may be used to advantage in any household. It comprises a convenient ironing table or skirt board, a strong step ladder, and a handy clothes drier.

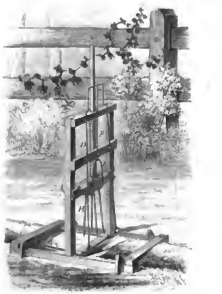
The body of the device consists of a board of the proper form and size for an ironing or a skirt board, divided into three parts, two of them forming, together with the steps and side rails, the ladder, A, while the third part is hinged to the other two, and forms the brace, B, which supports the ladder. Two lateral braces, C, are pivoted to the board, B, and are each divided into three pieces, two of which are pivoted to the main piece, so that they may be turned at an angle with it, forming a radial support for clothes. When the braces, C, are used for clothes drying, they are supported in a horizontal position by long hooks, which engage eyes in the under surface of the board, B. When they are employed to steady the step ladder they are folded compactly together, and their free ends are allowed to rest upon the floor. The legs, D, are pivoted to the side of the stepladder rails and are used as additional supports for clothes when occasion requires. When the device is used as an ironing table, the braces, C, are folded upon the board, B, and the latter is shut into the part, A. The legs, D, are then folded up, and the larger end of the board is placed upon a common table, where it is held by sharp spikes which engage the under surface of the table. The act of raising the small end of the ironing board forces these spikes into the table; the legs, D, being unfolded, the device is ready for ironing purposes, and appears as shown in Fig. 2. This ingenious combination was recently patented by Mr. J. H. Martin, of Hartford, N. Y.



COMBINED IRONING TABLE, CLOTHES DRIER, AND STEP LADDER.

NEW MOLE AND GOPHER TRAP.

The mole and gopher are great pests to the farmer



ROGERS' MOLE AND GOPHER TRAP.

and gardener, destroying enormous quantities of grain and doing great damage to gardens, lawns, nurseries, small fruit orchards, and young hedges. These animals are found in most parts of the United States, and, although they may not all be vegetarians, they actually destroy millions of dollars' worth of crops every year.

As many of our readers know, it is the habit of the mole to travel just beneath the surface of the ground, in search of worms and insects, upon which it feeds. Its subterranean paths are usually formed so near the surface that a ridge appears, indicating the track of the animal, and where this ridge is the grass withers. If one of these ridges be pressed down with the foot, the mole, on its return, reopens its track, and in so doing, restores the ridge to its original form.

To get rid of moles and similar vermin, a great deal of ingenuity has been experienced and a large number of devices have been patented. Among the latter is the trap represented in the accompanying engraving, which seems to possess advantages not before accomplished. It is set across the mole track after the ridge is pressed down, and is sprung by the animal in its attempt to reopen its track.

The trap has a spring-acted follower guided by the vertical frame, A, and carrying four sharp tines or spikes, B. In the lower portion of the frame is pivoted a lever or trigger, C, which is jointed to the sliding wire frame, D. A bail, E, jointed to the follower is engaged by the catch, F, when the trap is set, and the long arm of the catch is retained by the upper part of the sliding frame, D.

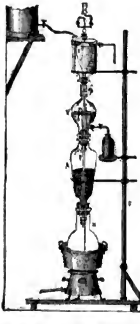
A short section of the ridge of the mole track is pressed down by the foot and the trap is pinned down over the flattened place. When the mole returns it presses the lever, C, upward in the act of opening the path, thus releasing the catch, F, when the tines, B, spring downward and impale the ani-

mal. For gophers the trap is fastened down over the mouth of the hole where he carries out earth. When it emerges with a load it presses up the trigger and springs the trap.

This useful invention was recently patented by Mr. Albert G. Rogers, of Lathrop, Mo., who will furnish further particulars.

APPARATUS FOR CONTINUOUS DISPLACEMENT.

To the long list of apparatus devised for continuous displacement or extraction, another has been added by Mr. G. Guérin, of Lyons. The flask, B, which has a wide neck, is intended to receive the volatile liquid used for extraction. Into the neck is fitted, by means of a tightly fitting cork, the percolator, A, containing the substance to be extracted. The percolator is connected with a globular receiver, V, containing three tubulures, the lateral one of which terminates in a stoppered bent tube, pointing into an empty bottle. Over the receiver is fixed a condensing apparatus, surmounted by a safety tube filled with mercury. The substance which is to be extracted having been introduced into the percolator, A, and a sufficient amount of the volatile menstruum having



GUERIN'S CONTINUAL DISPLACEMENT APPARATUS.

been introduced into flask, the apparatus is connected together, as shown in the illustration, and the water bath surrounding the flask, B, heated by means of the gas stove.

As soon as the liquid boils the vapors ascend through the central tube, T, into the pear-shaped receiver, I, which is kept cold by a supply of water. The upper part of the tube, T, where it passes through the joint, m, and through the neck of the condenser, is *not* in contact with the walls of the apparatus. Hence the condensed liquid flows down the sides of the condenser, I, into the receiver, V. The latter is provided with a small straight air tube and with a bent siphon tube, both communicating with the percolator below. As soon as enough liquid has accumulated in the receiver to rise over the bend of the siphon tube, it will begin to flow into the percolator, until the short leg of the siphon is clear of the liquid. The flow will then stop until it has risen to the former level. The liquid falling upon the substance in the percolator will penetrate it and finally pass into the flask, B, loaded with the soluble matters.

Fresh Meat from Australia.

On Friday, February 6, a number of visitors assembled by invitation of the firm of McIlwraith, McEacharn & Co., Leadenhall street, on board the Strathleven, one of Burrell & Son's line of steamers, now lying at the West quay, East India (Import) Dock, London, to inspect the "meat room" and the machinery, and to practically judge of the experiment of the practicability of bringing fresh meat by the freezing process from Australia, the first consignment of which came by this vessel.

On November 29 the vessel left Sydney, having on board 55 carcasses of beef and 257 carcasses of mutton. She proceeded to Melbourne, where an addition was made to that portion of her cargo by the shipment of 5 carcasses of beef and 295 carcasses of mutton, the total weight being from 30 to 33 tons. The Strathleven is 1,588 tons register, 2,436 tons burden. She left Melbourne on December 6, passing through the Suez Canal, and arrived at London on Monday, February 2. The whole of the meat must therefore have been killed about two months since. The chamber in which the carcasses were stored is about 26 feet square, and 6 feet 6 inches in height, and connected with it is an engine fitted with refrigerating apartments, the air being drawn out of the room, compressed, and chilled, and then forced back again through about 300 feet of piping. By these means an average temperature was kept during the voyage of from 10 to 15 degrees of frost. On Friday, although until the middle of the day the engine had not been at work since Sunday or Monday, the temperature was 23° Fah. About 3 tons of butter were also brought over in the same department. The vessel was 24 days in the tropics, and in the Red Sea the temperature was from 72° to 74°, but no difficulty was experienced in keeping the "meat room" at 12° of frost. It was not found necessary to have the engine constantly at work, and no chemicals were used.

After the inspection, the company sat down to luncheon, which consisted almost entirely of Australian fresh meats which had been brought over in the Strathleven. The *menu* comprised lamb cutlets, beef olives, stewed chops and asparagus, minced collops, roast beef, mutton, and lamb, boiled mutton, and corned beef.

The Premier of Queensland (Mr. T. McIlwraith), said it was the immense undeveloped resources of that colony which prompted the chairman to try the experiment of which the success had been proved that day. About £5 per head had been paid for the bullocks, which would have cost £28 or £30 per head in England. He referred to the immense capabilities of New South Wales and Queensland for producing meat, and expressed the belief that in the future a great trade would be developed. They could produce meat and sell it at a profit of 2*d*. per lb., and he had no doubt it could be placed before the British public for 4*d*. per lb.

Mr. A. McIlwraith, in responding to the toast of his health, said that the meat was purchased at about 1½*d*. per lb., and was expected to realize 6*d*. to 7*d*. in Smithfield Market. He hoped that in a short time he would be able to collect such information as would show that this meat could be imported on a much larger scale. If they could bring from 100 to 150 tons per week to England, it would relieve the surplus produce of the Australian colonies. Mr. T. McIlwraith next gave the health of Mr. James Campbell, C.E., who, he said, had really carried out the details of the experiment.

Mr. Campbell said that although fears were entertained for the success of the enterprise before they reached the tropics, no difficulty was experienced in passing through those regions, and he should have had no fears for the success of the experiment, even if a temperature had been experienced of 90°.

American Watches.

The American Watch Company, of Waltham, Mass., has lately received an order from the British Government for 372 watches, intended for the use of conductors, engineers, station masters, and other employés of the state railroads of India. This is the third large order received by the company from the same source, and, like the former ones, was obtained in public competition with foreign manufacturers. The London *Jeweler and Metalworker*, in its issue of January 15, observes, in reference to this order:

The contract for watches to be used by the officials on the Indian state railways has again been secured by the American Watch Company. This is the third time Messrs. Robbins & Appleton have received this distinction, which is not a barren one, for it must be evident to the most prejudiced individual that the timekeepers supplied on the previous occasions must have given satisfaction, and answered the tests required of them. This is a mortifying fact for Englishmen, especially for those who believe that were manufacturers here to show more enterprise, they would be able to compete advantageously in the manufacture of all grades of watches. —*Boston Advertiser.*

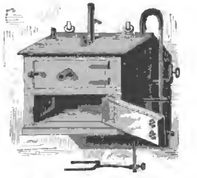
Light in the Home.

The eminent English writer, Dr. Richardson, produces in one of our contemporaries, an article called "Health at Home," which is replete with wisdom. A most important point, and one on which he dwells, is the fact that so many people are afraid of the light. "In a dark and gloomy house you never can see the dirt that pollutes it. Dirt accumulates on dirt, and the mind soon learns to apologize for this condition because the gloom conceals it." Accordingly, when a house is dark and dingy, the air becomes impure, not only on account of the absence of light, but from the impurities which are accumulated. Now, as Dr. Richardson cleverly puts it, we place flowers in our windows that they may have the light. If this be the case, why should we deprive ourselves of the sunshine and expect to gain health and vigor? Light, and plenty of it, is not only a purifier of things inanimate, but it absolutely stimulates our brains. It is in regard to sick rooms that this excellent authority is particularly impressive. It used to be the habit of physicians in old times to sedulously darken the rooms, and this practice continues to some extent even to-day. In certain very acute cases of nervous diseases, where light, the least ray of it, disturbs in over exciting the visual organs, this darkening of the room may be permitted, but ordinarily to keep light out of the room is to deprive the patient of one of the vital forces. Children or old people condemned to live in darkness are pale and wan, exactly like those plants which, deprived of light, grow white. Darkness in the daytime undoubtedly makes the blood flow less strongly and checks the beating of the heart, and these conditions are precisely such as bring constitutional suffering and disease. The suppression of the light of day actually increases those contagious maladies which feed on uncleanliness. Dr. Richardson states: "I once found by experiment that certain organic poisons, analogous to the poisons which propagate these diseases, are rendered innocuous by exposure to light."

DRYING OVEN WITH CONSTANT DRAUGHT OF DRY AIR.

Dr. Hermann Rohrbeck has devised some improvements in the usual drying ovens, whereby the complete drying of bulky precipitates at a constant temperature may be accomplished much more rapidly than usual.

The drying oven consists of a double walled square box, one side of which is provided with a door, or, as shown in the cut, with several doors. The upper surface shows three tubes, one of which communicates with the interior of the walls, and is intended for filling in water or other liquids, according as a higher or lower temperature is desired; the second (short) central tube communicates with the interior and is intended to receive a thermometer. The third (longer) tube, which is provided with a damper, is intended to regulate the draught and to allow the moist air to escape. The door or doors are also constructed with double walls, which are, however, not filled with water, but with fused calcium chloride. In the center of each door a tube, also containing a damper, is soldered upon the outer surface, by which the air enters the interior of the door walls, where it loses its moisture while passing over the calcium chloride, and it enters the interior by way of the star-shaped perforations in the inner surface of the door (see cut). In this manner the substance, which it is desired to dry, is constantly supplied with a current of warm dry air, and exsiccation proceeds quite rapidly. If a temperature of 100° C., or thereabouts, is to be maintained for a long time, an upright condenser may be connected with the tubulure through which the steam escapes, so that the water may be preserved at the same height. The apparatus is also provided with a water gauge, a faucet near the bottom for drawing off the water, and, if of the kind shown in the cut, with a double walled diaphragm, through which the water likewise circulates.



ROHRBECK'S DRYING OVEN.

As the joints are hard soldered, the water may be replaced by higher boiling substances, such as anilin, paraffin, etc., without injury to the apparatus. The oven may either be placed on a stand, or it may be suspended on the wall, as shown in the cut.

RECENT INVENTIONS.

An improvement in pantaloons pockets has been patented by Mr. Morris Shrier, of New York city. The object of this invention is to provide pantaloons with two separate and distinct side pockets under the same outside pocket flat, so arranged that one can be entered from the side and the other from the top.

An improved ticket holder has been patented by Mr. Samuel Herzberg, of Pontiac, Ill. It is designed for holding the tickets on which are marked the sizes and other particulars of goods, such as pantaloons and other clothing.

Mr. John Hill, of Columbus, Ga., has patented an improved feed indicator for cotton openers. This relates to a convenient and certain means for determining the quantity of cotton to be fed to cotton openers, which serve to tear up and loosen the tussocks of cotton as they come from the bale, and distribute the fiber in the form of a fleece. In using these openers, two are sometimes employed together to act successively upon the cotton; or one opener may be employed in connection with a lapping machine, the function of which latter is to press together and compact into a fleece. In either case a hollow trunk has been employed as a conduit, in connection with a blast of air passing through the same, to act as a vehicle to carry the fleece from one opener to the other, or from the opener to the lapping machine, which second machine is generally located upon a different floor, or at a point more or less remote from the first. The invention consists in making the boxes of the upper feed roll of the second opener or lapper vertically adjustable, and connecting them with an index hand within sight of the operator at the first machine, so that the operator, at a point remote from the second machine, can tell the amount of cotton fed to the second machine by the rise or fall of the movable roller due to the passage of a greater or less quantity of cotton to the second machine.

Mr. T. O. Memery, of Key West, Fla., has patented an improved hinge for awning blinds, which is easily applied, and is not more complicated than the ordinary blind hinge.

An improved stock car has been patented by Mr. Sanford Bray, of Charlestown, Mass. The object of this invention is to furnish cattle cars so constructed that the cattle will be arranged compactly, and can be conveniently loaded and unloaded.

AMERICAN INDUSTRIES.—No. 35.

THE MANUFACTURE OF SEWING MACHINES.

On the first page of this paper we present three views illustrative of the machinery used, and the methods of manufacture, in the factory of the Weed Sewing Machine Company, at Hartford, Conn., a firm which has for some time past taken a front rank in bringing the sewing machine to its present high state, and whose endeavors have been rewarded by a flattering degree of success, whether this be measured by the encomiums of those who are most expert in the business or by the rapidly increasing patronage of the public. In the engravings, the blacksmith shop represents what may, perhaps, be considered the commencement of the making of the working parts of the machine, and here are a number of drop forges in which these are struck out, homogeneous steel being principally used. Nearly every important piece of the machine, except the cast iron frame, is made by these forges, the exact pattern being first cut in the toughest steel. These dies are necessarily very costly in the first instance, but parts so made are always interchangeable; they make of each piece a thousand or more at a time, and every one stamped out must be a counterpart of every other one.

From this department the parts go to the machine room, shown in the large view at the top of the page, for milling, grinding, drilling, and a multitude of other finishing operations, and here also the cast iron work is finished. This room is filled with a great variety of costly machines, several of which would require considerable space to fully describe, but the ruling idea here, as in every other division of the business, is to have a perfect machine for each particular portion of the work. No part is so small but the most complete machinery is provided in order to make it just right, in the shortest time, and to insure the production of hundreds and thousands of the same part so they will be exact duplicates of the first one made. The shuttle, for instance, goes through thirty-four distinct operations, from the time it is cut from solid half inch bar steel until it is completed; all of these operations, with the machinery employed therein, were subjects of careful study and experiment, before the details of the work touching the production of shuttles were satisfactorily arranged. When this point is reached, however—and it is in a similar way that the work is carried on with reference to every other piece in the working part of the machine—then the manufacture proceeds like clock work, and the greatest exactitude and highest finish are regularly obtained.

In the "assembling" room, as its name indicates, the parts are put together, having previously gone through a testing room, where each separate piece is inspected and gauged, the defective ones being sent back to the machine room. As the machines are put together they are, at different times, placed upon "jacks" or frames driven by steam power at a high rate of speed, and run for some time, to insure that all of the parts are properly adjusted. From this room they are taken to another apartment, and again inspected piece by piece in their completed shape; after which each machine is sampled on various thicknesses of cloth, and with fine and coarse threads.

The japanning, or putting on the hard, polished black finish of the cast iron work, has a special department. The japan is put on with a brush, three coats being given, the pieces after each coat being baked for twelve hours, at a temperature of 360 degrees. After this process, and before the varnishing, the bronze and silver ornaments and fancy designs in colors are put on. This was formerly done with a brush, and anything as elaborate as the decorative work now put on machines would have been very expensive, but within the past two years the decalcomanie or transfer process has been generally adopted, and by this means the most profuse ornamentation can be quickly put on at a moderate cost. When this has been done, the varnishing is next in order, after which is another baking of twelve hours at a heat of about 160 degrees.

While it is not our purpose in this description to institute a comparison of the merits of the Weed machine with those of others in the market, it is not out of place to call attention to the special features to which the company principally attribute the deserved popularity of their machines. Four styles of machines are made, the "People's Favorite," the "Family Favorite," and two styles of the "General Favorite," the first-named being the lowest priced, while the latter are more especially intended for manufacturers, tailors, shoemakers, etc. All of these are alike distinguished for their simplicity of construction and perfect balance of parts, which renders them very unlikely to get out of order and reduces to a minimum the expense of repairs. The company claim that the latter class of machine is capable of being run at the rate of 800 stitches to the minute on leather work, and 1,250 stitches a minute on cloth, but in a New York factory the "General Favorite" is run on calf skin uppers for men's shoes at a considerably higher speed than the company claim. All the machines make an elastic lock stitch, the loop being formed in the center of the material; the "feed" is either drop or wheel feed, as customers desire, and the tension can be so easily regulated as to afford some of the advantages of an automatic tension. A special merit is also claimed for the superior work which this machine will do in the use of cotton or linen where silk had heretofore been employed—a point in regard to which manufacturers have experienced no little difficulty, as cotton, with what is called a "silk finish," where the stitches can be seen, is now used to a great extent in place of silk.

The Weed Company have been manufacturing sewing machines since 1866. They were the first to apply to this manufacture the principle of interchangeability of parts, and at an early day began to use forgings to a very large extent in place of cast or malleable iron. In all their sewing machines steel and forgings are used wherever possible, great care being taken that adjoining working surfaces be of metals of different nature, thereby causing least wear from friction, and provision being made for the taking up of lost motion wherever such may occur from long continued strain. Direct crank movements are the main principles of these machines, gears, springs, and cams being eliminated, thereby securing positive yet easy action. The shuttles used in the Family Favorite and General Favorite machines are alike, carrying over fifty yards of coarse thread, having only one hole through which to pass the thread. The automatic bobbin winder, shown in Fig. 2, is an especial feature of the Family Favorite machine, represented by Fig. 3, being patented and applied solely to it. Smoothly and evenly filled bobbins are a necessity for nice stitching, and this simple contrivance secures this end without trouble to the operator. All the modern improvements, such as "loose fly wheel," "casters in stand," "rubber socketed hinges," "adjustable balance wheel shaft," "needle sockets," "self-acting tensions," etc., are incorporated in this machine, while, of course, the never ending variety of attachments are as applicable to it as any other.

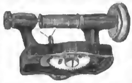


Fig. 2.—Automatic Bobbin Winder.

The works of the Weed Sewing Machine Company cover two acres of ground, and besides manufacturing the sewing machine, they make bicycles and an extensive line of fine steel and iron forgings for agricultural implements and steam machinery; also a number of other sewing machines for companies not having works of their own, among which is the McKay Twin Needle Machine, to the application of the principles of which the Weed General Favorite machine was especially suited. The power required is supplied by a 250 horse power engine, and the capacity of the factory is equal to the production of 250 machines a day.

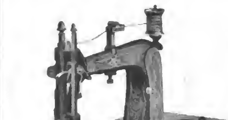


Fig. 3.—Family Favorite.

THE BICYCLE MANUFACTURE,

which is an important branch of business carried on at the Weed factory, is illustrated in the view at the bottom of the first page, in which are shown some of the final processes in the manufacture; on the left hand will be seen "forks," "backbones," "wheels," etc., in various stages of progress, and rows of completed machines awaiting shipment. The Weed Company are the sole manufacturers of bicycles for the Pope Manufacturing Company, of Boston, who control the patents for the United States on this specialty, and during the past year the demand for their "Columbia" machine has largely increased.

Although bicycles have been very popular in England for some time past, over 250,000 of them having been made there during the last few years, their adoption in this country has not been so general.

They differ in many points from the velocipede, the drive wheel being much larger, and the rider sitting almost vertically over the center of the wheel. It has been demonstrated that about as good "time" can be made with them as can be reached by the fastest trotters, taking only a mile or two at a time, while for long distances a good bicyclist will cover the ground in even quicker time than a horse can make. These "machine horses" have of late been coming into considerable favor, especially in Massachusetts and in the vicinity of Boston; such exercise is recommended by physicians, and, when one has acquired sufficient dexterity to be able to ride with facility, they afford the means, where the roads are open and good, of taking a kind of recreation which now promises to become more generally popular.

The great point in the manufacture of bicycles is to secure the maximum of strength with the minimum of weight, and the bicycle, as now made, is a splendid specimen of American workmanship. We say "American," because our mechanics have brought it to its present state of perfection, in England it is made in a number of factories, where most of the work is done by hand, and no one establishment has taken hold of the work in earnest, as is now being done at the factory of the Weed Sewing Machine Company. Here the same thorough and costly preparation as has marked their perfecting of the machinery for the manufacture of sewing machines is now evinced in their bicycle manufacturing department. The hub of the bicycle is forged in one piece of homogeneous steel, case-hardened, as are also the cranks and yoke, with dies made after patterns which embrace all the latest improvements. The steering head is a solid forging, and the backbone, as the tube is called, which extends from the yoke to the small wheel in the rear, is of steel, brazed to the head. The seat rests on a spring attached to this backbone, the spring being held by a sliding clasp. Wire of 12½ gauge is used for the spokes, which are headed in the fellies and then tightened in a socket at the hub by a nut. It is a work of considerable nicety to put a machine together, after all the parts are ready, so each spoke will be true and have its proper bearing; but they are tested as to how they will "track" until the variation is below one-sixteenth of an inch. The fellies are either V shaped or half round, and the tire is solid rubber, round, made especially for this purpose, and cemented in its place. The different sizes made range from 36 to 60 inches for the diameter of the large wheel, and the weight will vary from 40 to 55 pounds. There is, of course, a wide range of prices, which vary with the size of the machine, and the finish, there being three different styles made, known as the "special," the "standard," and the "ordinary," varying in material and design to suit the public tastes, from the heavy roadster to the light and trim racer, with ball bearings and all the latest devices to avoid friction and secure speed, strength, and lightness. The "Columbia" standard is a practically serviceable machine, especially suited to the wear and tear of ordinary American roads. In the construction of the higher priced machines nothing but steel and the finest forgings are used, to insure the greatest strength and rigidity with the least weight and most graceful shape. The company have thus far made about 1,200 bicycles, but now have orders on hand for 2,500, and they expect to be able to turn out 500 a month.

Although no "records" have been made in bicycling here to compare with what has been done in England, there have been many cases reported in which quick time has been accomplished for both long and short distances. One instance is given where forty miles were made in 3 hours and 36 minutes, and another where 100 miles were made in 11 hours and 45 minutes, including stops, the riding time being 10 hours and 15 minutes. In England, however, single miles have been made in a little less than three minutes, and from that up to thirty miles at a speed greater than a mile *each four minutes;* 212 miles have been made in less than 24 hours, and at Agricultural Hall, London, in April, 1879, 1,170 miles were made in six days. The difficulties of learning to ride a bicycle are said to be not as great as learning to ride horseback, or to skate or swim, and the healthfulness of the exercise, with the advantages which so simple and efficient a means for rapid locomotion offers to those so situated that they can avail themselves of it, would seem to give promise of its steadily increasing popularity.

Velocity of Rifle Balls.

Prof. Spice recently measured, before a large audience, the velocity of a rifle ball fired across the stage. The distance was only 33 feet. Lieutenant Merriam co-operated, and his duty was to shoot away, with a Creedmoor rifle, two loose wires, each of which connected in an electric circuit two globules of mercury. One wire was placed just in front of the supported muzzle of the rifle, the other 33 feet distant. Two levers were arranged, with bent wire points, over a piece of smoked glass to which a uniform motion could be imparted, and the electric connections were such that on the first wire being broken the point of the corresponding lever descended on the glass; but when the bullet broke the second wire it immediately rose again by the action of a spring. The result of this was that the point connected with this lever scraped a very short line on the smoked glass. The other point, being kept down during the swing of a seconds pendulum, scraped a longer space. After firing, the glass was withdrawn, and a magnified image of the lines thrown on a screen. The relative lengths of these lines were then ascertained, the longer being found 110 inches, the shorter 5 inches, making the duration of flight of the ball 5-110ths or 1-22d of a second, its velocity being $33 \times 22 = 726$ feet per second, or at the rate of a little under 500 miles per hour.

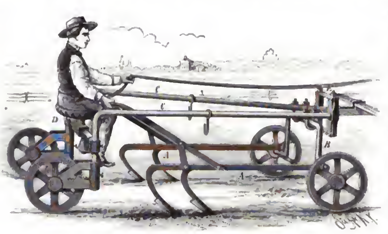
THE unreasonableness of mankind in general is pretty truthfully illustrated in the following item from the *Builder and Woodworker:* "When a man's house is building, he never thinks the carpenter puts in one-third enough nails, and frequently, and with biting sarcasm, asks him if he doesn't think the house would stand if he just simply leaned it up against itself and saved all his nails? Then, a few years afterward, when he tears down his summer kitchen to build a new one, he growls and scolds, and sarcastically wonders why that fellow didn't make the house entirely of nails, and just put in enough lumber to hold the nails together."

IMPROVED RIDING ATTACHMENT FOR CULTIVATORS.

We give herewith an engraving of a new riding attachment for cultivators, recently patented by Mr. Henry Cole, of Cedar Hill, Ohio. It is constructed so that it may be applied to any of the cultivators now in use, and will enable the driver, while riding, to guide the plows without great exertion, and permits of full control of the shovels. It is light on the horses, and may be turned in growing corn without breaking it down. The beams, A, of the cultivator have plows and handles attached in the usual way, and their forward ends are supported by the bent axle, B. To this axle two bent bars, C, are attached by a head, E. These bars are supported at their rear ends by caster wheels, and are connected by a cross bar, D, which supports the driver's seat. The tongue by which the attachment and cultivator are guided and drawn forward passes through the head, E, is jointed to the bars A, and has the same movement as a common wagon tongue.

The advantages of this device will be understood and appreciated by those who have used the common cultivator.

The inventor may be addressed for further particulars.



CLOE'S RIDING ATTACHMENT FOR CULTIVATORS.

New Electric Lamp.

According to our English contemporaries, Mr. J. W. Swan, of Newcastle-on-Tyne, patentee for the carbon process of photography, has taken out a patent for improvements in electric lamps. It is stated that Mr. Swan has succeeded in making a lamp which gives a perfectly steady light, and is indefinitely durable. The light is produced by the incandescence of carbon, and ranges in power from one to ten gas burners. It is described as a moderate and pleasant light. It is claimed, on behalf of Mr. Swan, that many years ago he used carbonized cardboard, the feature in the Edison light.

We hope it may prove true that a lamp has been invented which will render the electric light a steady one, and we have no objection to Mr. Shaw being the fortunate discoverer of it. But this flickering difficulty has been so often overcome, according to the newspapers, both at home and abroad, that we have some doubts if the anti-flickering lamp has been found yet.

Transmission of Motive Power by Electricity.

At Shaw's Water Chemical Works, Greenwich, a neighboring waterfall furnishes the power to drive a circular saw, a turning lathe, and a vertical boring machine. Two Siemens machines and a water turbine are employed. The turbine is driven by the fall, and one machine is driven by the turbine. The current from the latter is conveyed to a second machine in the workshop 150 yards distant, and keeps the latter going. From this machine the tools above mentioned are driven by means of belting.—*Electrician.*

NON-CONDUCTING COVERING FOR HEATED SURFACES.

To secure the highest economy in the use of steam or in the use of heating or cooling agents, it is absolutely necessary to protect generators, pipes, and all other needlessly exposed radiating surfaces, with a non-conducting covering to prevent loss of heat by radiation or convection. The essential features of such a covering are, primarily, a low heat-conducting power and facility of adaptation to different surfaces, but in addition to these requisites it must be light, incombustible, and easily applied or removed.

There are numerous substances that will fulfill one or two of these requirements, but a perfect covering should embody all of the features enumerated. It is unnecessary to point out, except in a general way, the imperfection of many of the coverings now in use. Mineral substances, as a class, are fairly good conductors of heat, and are not, therefore, well adapted to the purpose. Hair and wool are, in themselves, good non-conductors of heat, but in the coarse felted form in which they are usually applied, these natural good qualities are not utilized to the best advantage, and besides this heat exerts a destructive action on hair or wool, so that they, in time, become friable, rendering it unfit for reapplication. Wood, which is sometimes used, is liable to warp and crack, and thus destroy its efficiency.

The Burgess non-conductor—the application of which we illustrate on this page—combines the advantages of all other non-conducting coverings, and is inexpensive, easily applied, very light and strong, and not affected by changes of temperature. It is applicable to plain or curved surfaces, pipes, elbows, and valves. It may be readily sawed, cut, and fitted by unskilled persons, and should occasion require, it may be removed and replaced without injury.

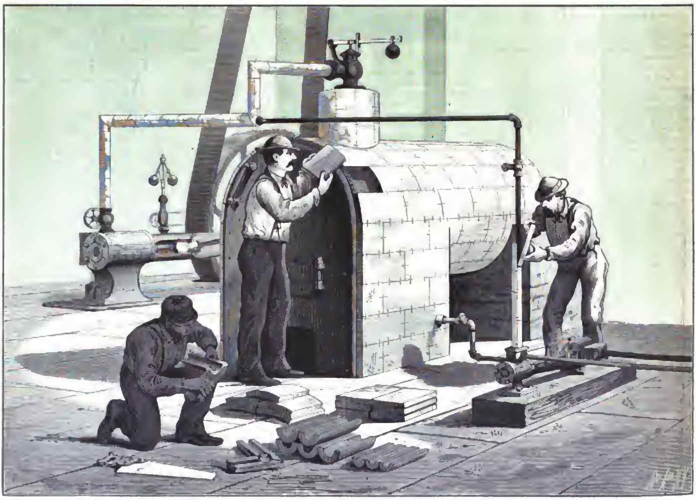
It is composed of vegetable fiber and sawdust, moulded into a light but firm body of sufficient compactness to prevent the permeation of heated air through it, while its porous texture insures that cellular structure most effective for non-conducting purposes. The covering is rendered incombustible by a peculiar process.

In applying the non-conductor to steam pipes, the end of one section is placed at the middle of the opposite section, so as to break joints, and the edges of the sections are pressed well together and secured by staples or by bands passing around the pipe-covering, which is afterwards covered with canvas. The sections may be mitered and adapted to elbows and bends by means of ordinary wood working tools.

The machinery employed in making this covering is equally well adapted to mineral fiber, such as mineral wool or asbestos, and this company manufacture a special mineral covering for steam pipes conveying superheated steam.

We are informed that the great strength of this covering is due to the concentric arrangement of the fibers composing the sections.

Further particulars may be obtained by addressing the Burgess Steam Pipe Covering Company, N. W. corner Twentieth and Ridge avenue, Philadelphia, Pa.



BURGESS' NON-CONDUCTING COVERING FOR HEATED SURFACES.

MEDUSÆ.

Discophora, a sub-class of hydrozoa, contains a number of free ocean swimming forms, mostly known as jelly fish, often growing to a very large size. In the first order (*Rhizostomidæ*) the tentacles hang down like a bundle of twigs from the under central portion of the umbrella-shaped mass, as is well seen in *Rhizostoma cuvierii*, a beautiful species often to be found in great numbers cast ashore on the south coasts of England and Ireland. In the second order (*Pelagiadæ*) the tentacles are placed all around the margin of the umbrella. The mouth is central. The accompanying figure will give some notion of these fragile forms. They are rarely solitary, but seem to wander about in considerable battalions in the latitudes to which they belong. During their journey they proceed forward with a course slightly oblique to the convex part of their body. If an obstacle arrests them, if any enemy touches them, the umbrella contracts and is diminished in volume, the tentacles are folded up, and the timid animal descends into the depths of the ocean.

In respect to size the species vary immensely. Some are very small, while others attain more than a yard in diameter. Many species are phosphorescent during the night.

Most of them produce an acute pain when they touch the human body. The painful sensation produced by this contact is so general in this group of animals, that until very recently all the animals of the group have been, after Cuvier, designated under the name of Acalephæ or sea nettles, in order to remind us that the sensation produced is analogous to that occasioned by contact with the stinging leaves of the nettle.

MEDUSÆ.

Bundles of Snakes.

The statements made by Humboldt as to the piles of snakes he saw in Guiana, can be verified here in our northern woods and swamps. I personally had the pleasure of observing it twice, both times very early in spring, and in locations which could be called wildernesses. I first saw such a bundle of snakes in the neighborhood of Ilchester, Howard county, Md., on the stony bank of the Patapsco river, heaped together on a rock and between big stones. It was a very warm and sunny location, where a human being would scarcely disturb them. I reasoned that the warmth and silence of that secluded place brought them together. Some hundreds of them could be counted, and all of them in a lively state of humor, hissing at me with threatening glances, with combined forces and with such a persistency that stones thrown upon them could not stop them nor alter the position of a single animal. They would make the proper movements and the stone would roll off. All the snakes in this lump were common snakes (*Eutænia sirtalis*, L.). The second time I noticed a ball of black snakes (*Bascanion constrictor*, L.) rolling slowly down a steep and stony hillside on the bank of the same river, but about two miles above Union Factory, Baltimore county, Md. Some of the snakes were of considerable length and thickness, and, as I noticed clearly, kept together by procreative impulses.

It is surely not agreeable to go near enough to such a wandering, living, and hissing hundred-headed ball to examine the doings and actions, and search for the inner causes of such a snake association. As, furthermore, the localities for such mass meetings of snakes are becoming rarer every year, and our rapidly increasing cultivation of the country must make it hotter for snakes everywhere, only a few naturalists could see such a sight, even if they should look for it in proper time, which, as stated above, seems to be the first warm days in spring.—*E. L., Ellicott Mills, Md.* —*American Naturalist.*

The Circulation of the Blood Made Visible.

Dr. C. Hüter, a German *savant*, of Greifswald, has devised a simple arrangement which demonstrates the circulation of the blood in the human body by making it visible. Dr. Hüter's method is as follows: The patient's head being fixed in a frame, on which is a contrivance for supporting a microscope and a lamp, his lower lip is drawn out and fixed on the stage of the microscope by means of clips, the inner surface being uppermost, and having a strong light thrown upon it by a condenser. When these preparations are completed all the observer has to do is to bring the microscope to bear on the surface of the lip, using a low power objective, and focusing a small superficial vessel. At once he sees the endless procession of the blood corpuscles through the minute capillaries, the colorless ones appearing like white specks dotting the red stream. Dr. Hüter asserts that by taking careful note of variations in the bloodflow and changes in the corpuscles he has derived great advantage in the treatment of medical cases. This is the first instance of the flow of the vital fluid in one person being watched by another.

An Odd Fish in the Far West.

A correspondent writing from Hutchinson, Kansas, to the St. Joseph, Mo., *Herald*, says: "This place is considerably excited over the finding of a fish with four legs and a frill or sort of a ruffle about its neck, in a well forty feet deep. This little curiosity is the same as that discovered by Professor O. C. Marsh, in 1868, at Lake Como, in Wyoming Territory, to which he gave the name of *Siredon lichenoides*. Out in that territory they are known as the "fish with legs," and are from five to ten inches in length. The one found at this place is about three inches in length, as a siredon enjoys the external branchial appendages or gills, making a partial frill to the neck, and membrane along the back and tail, resembling that of the tadpole. The head is like that of the yellow catfish, the body of a dark olive color, and partly transparent.

According to Professor Marsh's experience with the siredons, this little creature will undergo a change like the tadpole, and the beautiful ruffle about the neck and the tadpole-like membrane will be absorbed by the body, various other changes will follow, and the little wonder of Hutchinson will be transformed into a complete animal, formerly known as the *Amblystoma mavortium*, and the doctrine will be proven that all siredons are merely larval salamanders.

Curious Mental Relations of Self-Consciousness.

What constitutes individuality or personality has long been one of the hardest nuts for metaphysicians to crack. There was a famous instance in the early part of the seventeenth century, on which both Descartes and Spinoza sharpened their wits. A Spanish nobleman received a blow on the head, from which he apparently recovered completely, but with total forgetfulness of everything and everybody that he knew previous to his injury. He was obliged to learn the language anew, and could not be brought into any mental relation with his former self, though in other ways quite sane. Spinoza does not hesitate to say that he was a different person than before, another individual.

His argument is subtle; in a modern version it may be stated thus: as we recognize personality to continue, although all the matter of which the body is composed changes every few years, or, as some say, every few months, the element of personality must rest in the continuity of psychical impressions; when this is absolutely dissevered, then personality ceases; otherwise, if we maintain that it does not, because the body remains, we are in the position of the man who claimed his knife was the same after he had got a new handle to the blade and a new blade to the handle!

Physiology comes to the aid of metaphysics by defining the sense of personality as one of the cerebral forces dependent on nervous action at once continuous and related. There are examples where it is continuous, but not related. A famous example occurred in the Franco-German war. A soldier wounded in the head recovered with the odd sequel of a double mental life; for several weeks he would live one life, then pass into another, with no recollection of the former one, but with its own independent series of acquisitions and impressions; then he would revert to his first life again without a shadow of memory of his intermediate existence, and so on alternately.

This duplicate existence is quite common in epileptics, and the clinical records of that malady offer a number of carefully recorded cases. In a less degree it may be said to be the case in dreams. It is explainable on the supposition that certain portions of the brain are active at one time, dormant at another, or that during one period one half of the brain is at work while the other half is not; and that when this condition is reversed, total forgetfulness of the intervening period ensues.

Several recent cases have been recorded in the medical journals analogous to those we have referred to. In one, a man of about fifty years, with some money, well dressed, and with a traveling bag, found himself in a small city in Ohio, without any knowledge of who he himself was, whither he was going, or whence he was from. On other subjects he was perfectly sane, proving quick at figures and an expert penman, of good education and polished manners, altogether a competent man of business, except this one extraordinary and remarkable trick of memory. What is unusual and a little suspicious was the fact that nowhere about him was any old letter, note book, mark on his linen or clothing anywhere, which bore a name, initials, or monogram. It looked as if he had prepared himself to lose himself. It were well, if this thing grows common, for every prudent man to have a line in his pocketbook to this effect: "Mem: I am John Smith, of Smithville," so that when he forgets who he is, he can remind himself of the fact.

In one of the recent numbers of *Lippincott's Magazine* is a case, probably an imaginary one, but quite consistent with facts, where a man believes he has lived two distinct lives, remembering each with equal certainty; one as a well-to-do lawyer, the other as a needy New England farmer. As he was in truth the latter, the "remembering happier things" was constantly to him, as the poet says, "a sorrow's crown of sorrows." In certain forms of progressive paralysis, the "*delire des grandeurs*," an analogous condition, is witnessed. The confident belief expressed, and no doubt entertained, by Mahomet, Swedenborg, and other mystics, that a large part of their lives was spent in heaven, or in delightful converse with heavenly visitors, is a closely allied delusion. The common mental trick of almost unconsciously doing an

action or keeping up a formal conversation while the intellect is delighting itself in wholly remote fields of thought or imagination, so beautifully described in Xavier de Maistre's "Voyage autour de ma Chambre," under the figures of *la bête et l'ame*, illustrates how closely the ordinary processes of the mind may parallel these extraordinary vagaries.—*Medical and Surgical Reporter.*

MISCELLANEOUS INVENTIONS.

An improvement in oil cans has been patented by Mr. Jacob Rhule, Jr., of Pittsburg, Pa. The object of this invention is to provide a safe and convenient receptacle for oil; and it consists in providing an oil can with a stopper which, if the can be accidentally overturned, will not allow the oil to escape.

Mr. William Huey, of Cambridge, Md., has patented an improved means for transporting eggs and other fragile or perishable articles. It consists, first, in a case formed with parallel partitions subdivided into cells for the eggs by elastic wings secured flexibly upon one side to the parallel partitions, and overlapping at their free ends to form expansible cells or pockets to receive and protect the eggs.

Mr. William A. Galbraith, of Flint, Mich., has patented an improvement in that class of carriage poles that are capable of being adjusted and readily fitted to vehicles of any width, the object being to decrease the weight of the poles and make them more durable and effective in their operations.

Mr. James W. Hammett, of Willow Island, West Virginia, has patented a simple and effective apparatus for making wells. It consists of several distinct parts or tools that must co-operate to effect the purpose aimed at. The invention cannot be clearly described without engravings.

Mr. Louis M. Candidus, of Brooklyn, E. D., N. Y., has patented an improved apparatus for curing leaf-tobacco by means of steam without contact between the steam and tobacco, and at the same time carry off the vapors expelled from the tobacco.

Mr. James B. Parker, of Memphis, Ala., has patented an improved cotton picker, which consists in combining with a suitable framework and driving mechanism improved devices for picking the cotton from the bolls, for removing the fiber from the pickers, and for carrying off the collected fiber.

Mr. William W. Bolles, of Toledo, O., has patented an adjustable ornamental window cornice that without alteration can be adjusted to a window of any width. The invention consists of an ornamental piece of moulding, on which are secured thicker and grooved or channeled edges, and on each end of which is rigidly fixed a mortised truss, the whole forming the center piece of the cornice. The side extensions of the cornice consists of two pieces of moulding that are made to slide in the mortises of the trusses and the channels or grooves of the edge strips, and meet behind the center piece. The mortises in the trusses conform in their general outlines with the outlines of the mouldings, and the trusses are also cut through from their tops to the mortises, in order to make them so elastic that they will not bind on the sliding cornice extensions.

Mr. William C. Doddridge, of New Madrid, Mo., has patented an improved heating device of the kind forming an attachment or appendage of a stove or furnace pipe, and commonly employed as a substitute for a stove or grate in apartments contiguous to that in which is situated the stove or furnace with which such pipe connects.

Mr. Charles Rosencrans, of Philadelphia, Pa., has patented an improved box loop for harness saddles provided with transverse ribs which keep the leather covering in its place, and also protect it from abrasion and wear, and having a solid flat bottom with centrally projecting lugs.

Steam Pressure and Temperature.

The temperature of steam developed from water by boiling will be in an unconfined state 212°. This temperature is increased by putting a pressure on the steam, *i. e.*, by confining in a closed vessel, provided with a safety valve to work at a certain pressure. The following will give an idea of the ratio in which the temperature rises in steam under pressure:

Pressure.	Temperature, Fahr.	Increase of Temperature.
1 lb.	214°	
100 lb.	338°	124° first 100
200 lb.	388°	50° second 100
300 lb.	422°	34° third 100
400 lb.	448°	26° fourth 100

Natural Lime.

To the Editor of the Scientific American:

In Vol. xlii., No. 2 (new series), SCIENTIFIC AMERICAN, January 10, 1880, page 25, a correspondent of the *American Architect* is quoted, giving a lucid account of "Kansas Natural Lime." He closes with the inquiry, "Does such a strange product as this occur in any other section of our continent?"

I answer, yes. From 1870 to 1874 I was United States Consul at Paso del Norte, Mexico. And, while prospecting for silver ore, I discovered a large deposit, in what miners term pocket formation, of natural lime, located in blue limestone, in the foot hills, one and one-half miles west from the city of Paso del Norte, Mexico. I gave it various trials, and found it to possess all the good qualities of manufactured lime, and for whitewashing far superior to the manufactured article. WM. M. PIERSON.

Fort Bayard, Grant County, New Mexico, Jan., 1880.

New Transit Instrument.

At a recent meeting of the Massachusetts Institute of Technology, at Boston, Mr. S. C. Chandler exhibited and explained a new astronomical instrument designed by himself, for the determination of time and latitude. It is, in brief, a self-adjusting transit instrument. Instead of depending upon the ordinary means of accuracy, such as nicety in fitting the pivots, setting and observation of spirit levels, and other parts, the new instrument is made to float on mercury, and thus level and adjust itself. The instrument was explained as follows by the inventor:

It consists of a base of walnut, with approximate leveling screws at the four corners. From the middle of this base rises a pillar of black walnut firmly bolted to the base and surrounded by collars of hard brass. An outside sleeve of hard brass which turns on these collars supports the remainder of the instrument; this sleeve being rotated in azimuth by a rack and pinion movement, and provided at its base with a graduated setting circle. On top of this sleeve is a wooden crosshead, which supports a wooden trough in the form of a hollow rectangle, and in this trough is placed mercury to a depth of one-eighth of an inch. The trough is constructed of wood instead of brass, because the mercury would attack brass. Whether it would be better to use cast iron is an open question.

In this trough, on the mercury, there floats a wooden float, also in the form of a hollow rectangle, and nearly as large as the inside of the trough, this float being held in position at the middle of the two sides by two cast iron pins, which move in vertical slots in the sides of the float, and which are sufficiently loose not to interfere with its floating freely, but which serve to prevent any violent or sudden motion.

The above mentioned float has attached to it two brass arms, which support the telescope, the latter projecting through the hollows of the hollow rectangles of the float and trough.

The trough is not supported in the middle, but nearer one end, in order to allow of zenith observations; and on this account a counterpoise is attached at the other end of the trough.

The attempt has also been made to so proportion the parts as to bring the center of gravity of the floating part as near the axis of oscillation of the telescope as possible, in order to reduce oscillations due to jars, etc.

The illumination is effected by a series of reflectors, and comes from the side. The cross hairs are horizontal, and not vertical, as in the transit. The reason for this will be explained later. In using the instrument the telescope is set at a certain inclination to the vertical, and as the instrument is rotated in azimuth, the line of sight sweeps out a horizontal small circle of the heavens, *i. e.*, a circle of which the zenith is the pole.

For the determination of the zenith, the free upper surface of a liquid is used, and we have dispensed with the error of pivots, the error of level, and the error of azimuth, and have left only what is, in a certain sense, analogous to the error of collimation in a transit instrument, the characteristic of both errors being that the telescope describes a small circle, parallel, but very close, to the circle in which it is intended to revolve. The amount of this deviation in this instrument is not, however, determined by reversals of the telescope, as in the case of the transit, but by observation of the stars, in a similar way to that by which the azimuth error of the transit is found. As to the disturbance of the instrument by oscillations, the most violent oscillations I have been able to produce have required thirty seconds to have their effect dissipated, and after this time has elapsed the instrument is as quiescent as though it were mounted on stone.

It is, of course, specially adapted for observing equal altitudes, and can also be used to observe the transit of stars across any desired small circle having the zenith for a pole, and hence the reason why the cross hairs are horizontal instead of vertical.

All observations are influenced by refraction, but refraction operates to elevate all the stars equally at the same time. Hence we can disregard the error of refraction in a series of observations taken so near each other that there is no probability that the coefficient of refraction of the air has changed, and we can simply account it as part of the instrumental error; it having the same coefficient, hence when the observations are reduced to middle time this error is almost wholly eliminated. Next, as to the results that can be obtained by this instrument, I have not yet been able to make a great many observations, but those that I have made encourage me to believe that when as good mounting is given to it as is given to an astronomical transit, better results can be obtained with it than with the latter. I have used it very roughly, making observations from the roof of my house, which was subjected to a constant jarring from the teaming in the street below, and where the instrument was exposed to the wind.

I have compared my results with those of larger coast survey transits, and mine are the best.

I have not yet determined all the constants of the instrument. I find that the wind does interfere with it somewhat when employed in the open air and unprotected, but the deflections from this cause are but momentary, and errors due to a draught would be nearly eliminated were a greater number of cross hairs used.

Next, as to latitude. The transit instrument, when placed in the meridian, is used only for time; it can be used for the determination of latitude if placed in the prime vertical. The Coast Survey have introduced for this purpose the zenith telescope, and have obtained with it the very best results. To compare my instrument with this is a very severe test; although I have had only three evenings on which I could make observations for latitude, the results obtained are remarkably good. The claims, therefore, that I make for my instrument are the following, viz:

1. The ability to use any part of the heavens that are not obscured by clouds. In using the transit it is often impossible to obtain observations when clouds hang in the meridian, even though there be any amount of clear sky on either side. With my instrument we can use any region of clear sky in the heavens, as we can use any horizontal circle whatever; although the use of the same circle all the time renders the computations easier.

2. There is only one instrumental error to determine, instead of four.

3. This instrument is unaffected by errors in mounting.

4. Simplicity in use; requiring no readings of level nor reversals. In the use of the transit about one-half the time is taken up by these processes, which are unnecessary with my instrument.

5. The construction is very cheap.

6. Combination of a time and latitude instrument in one.

7. It admits also of the application of a delicate micrometer on an entirely new principle, as a micrometer screw carrying a weight could be mounted on the float, thus enabling us to move the center of gravity of the floating part, and to tilt the axis of the telescope. We can thus apply here the same methods that we can in the zenith telescope.

The Atmosphere and Yellow Fever.

During the yellow fever epidemic of 1879, Mr. William Van Slootin, C.E., of New Orleans, made chemical analyses of the air from September 9 to November 24, and found, according to Dr. Clendinning, of Fort Lee, N. J., a series of extraordinary variations in the amount of free and albuminoid ammonia to the million of cubic feet of atmosphere. These corresponded very curiously with the progress and fluctuations of the epidemic. For instance, on September 9, the analysis showed 125·69 grains of free and 250·36 grains of albuminoid ammonia to each 1,000,000 of cubic feet of air. On September 19 the amount of albuminoid ammonia stood at the extraordinary figure of 400·75 grains. This was its highest point, and, with many fluctuations from day to day, it gradually declined as the epidemic wore out its fury, until on November 24 the amount was only 47·26 grains. The curve of the free ammonia was less regular, but the decline had a general correspondence with that of albuminoid, until on November 24 the amount had fallen to 28·31 grains. The amount of ozone showed a similar variation from half a grain per 100 cubic feet of air on September 18, to seven grains on October 22, from which it appeared that the increase of ozone was accompanied by a constant decrease of ammoniacal products. The fluctuation of both from day to day and week to week, as the wave of the epidemic rose and fell, was very striking.

Surveying by Photography.

This was the subject of a lecture lately delivered at the Plymouth Athenæum, by Mr. W. G. Tweedie. The lecturer proposes to use for the purposes of surveying a camera by which a cylindrical projection of the objects is taken on a flat plate. Two such photographs, taken from the extremities of a measured base line, will, he declares, supply all the necessary data for making a map of the whole of the country in front. From these two photographs, by means of two scales of simple construction, the surveyor's work hitherto done in the field will be equally well performed in the office, and by the use of dry plates, the operator is relieved from all chemical operations in the field. The plates can be bought ready prepared, and sent to the professional photographer to be developed. The lecturer exhibited several remarkable instantaneous photographs he had taken, and explained the nature of the camera used and the *modus operandi*. In the subsequent discussion, it was suggested that Mr. Tweedie should practically test his invention by surveying on his new method some of the ruined castles on the moor.

Electrotyping with Iron.

Herr Böttger describes a process for steeling copper plates by electrolysis. 100 parts of ferrous-ammonia sulphate, together with 50 parts of sal-ammoniac, are dissolved in 500 parts of pure water, a few drops of sulphuric acid being added to acidulate the solution. The copper plate is connected to the negative pole of a battery of two or three Bunsen elements, an iron plate of equal size being employed as an anode. The solution is maintained at from 60° to 80°. The deposit of iron is of a hard, steel-like quality, and is very rapidly formed.

Capsuling Bottles.

In France a new system of capsuling bottles has come into vogue which is more rapid than the use of metal capsules, and is thought, by some, to give a more elegant effect. The neck of the bottle is dipped into a viscous volatile liquid and immediately withdrawn with a rotary movement. This leaves a transparent capsule, the effect of which is improved by first attaching a monogram or trade mark to the top of the cork or upper end of the bottle neck. The following is the formula for the liquid: Yellow resin, 2·0 parts; ether, 40; collodion, 60; fuchsine, or other tint, *q. s.*

Exhibition of Earthenware.

An International Exhibition of earthenware, chalk, cement, and gypsum industry is to be opened at Berlin from June 29 to August 10, 1880. The following are the rules for sending objects to the Exhibition:

1. Only such objects can be sent to the Exhibition as are directly or indirectly made of brick, tiles, earthenware, chalk, cement, or gypsum.

2. The committee has to decide about the named objects, and of the amount of space granted to the exhibitors.

3. Application must be made before the 15th of March, 1880, but it is most desirable to have the applications as early as possible, so that the space may be fixed, especially as there is the prospect of nearly all nations taking part in the Exhibition.

4. The forms of application are to be made in duplicate by each of the exhibitors, and to be sent to the president of the committee—Herrn Paul Loeff, Privat Baumeister, Berlin, S. W.

5. Should the object be admitted, a certificate of admittance will be made out on the information paper, which at the same time contains a declaration of the exhibitor. One of the application papers will be returned as a receipt. Only those exhibitors who possess a receipted form can be admitted to exhibit different objects.

6. All the admitted objects must be at their proper places (appointed by the committee) three days before the opening of the Exhibition, in perfect order and dry colors. The committee reserves the right of deciding about the unoccupied space, without being obliged to return the money. Other places than those given by the committee are not allowed to be used.

7. The committee will give a number to each object, before it is placed in the Exhibition building, which will correspond with the number in the Exhibition catalogue. This number must be fixed to each object, so that it can be seen for the whole time the Exhibition is open.

8. All exhibitors, their agents, or their workmen, must submit themselves to the committee, or to the officials of the Exhibition.

9. The committee does not undertake any responsibility in case of damage or loss of those objects which are brought to the Exhibition, but they will take the greatest care in watching the objects. Fire or light can only be used by specially written allowance from the committee.

10. The committee will undertake to arrange for the fire insurance if desired, but the expenses fall upon the exhibitors.

11. The price for space occupied is fifteen marks per square meter; unoccupied space will be eight marks the square meter. The minimum price for occupied space will be twenty marks, and for unoccupied space twelve marks per square meter.

12. The exhibitors must clear their objects immediately after the Exhibition is closed, but no object can be removed before the final closing.

13. An Exhibition agency, which will be put under the control of the committee, will carry out all commissions given by exhibitors for a small payment. The exhibitors have to take upon themselves the transport of the Exhibition objects, as well as unpacking, arranging, and repacking. The committee has made arrangements to have the work done by their agents at a small expense, in order that the exhibitors may be saved from overcharge, as has been the case at former Exhibitions. If desired by exhibitors, artisans and workmen can be provided for by the committee at the lowest rate.

14. No exhibitor is allowed to put an engine into motion before he has obtained special permission from the committee. This permission will be given on the fulfillment of the rules. The supply of the necessary material is to be arranged in each case with the committee.

15. If special architectural plans are desired, they have to be named under No. 9 in the forms of announcement; if necessary, designs should be added. At the wish of the exhibitors, the committee will undertake the erection of such engines as are required.

16. Those exhibitors who want special foundations must have them erected by the committee, and pay the necessary expenses.

17. Prizes will be given in each section, but a juror cannot be an exhibitor in his own section. The names of the jury will be published in the middle of July.

18. The Exhibition catalogue will contain advertisements, and each exhibitor can make use of the allotted space by paying 75 pfennings (or $9\frac{1}{2}d.$) for a *petit* line.

19. The committee reserves the right of altering these rules, and retains the power of refusing such applications as are thought unsuitable.

20. Demand will be made for the return by the railway authorities, gratis, of all objects which are not sold, the result of which will be published in due time.

PAUL LOEFF,
The President of the Committee.

DURING the recent Applied Science Exhibition, Paris, a diploma of honor was awarded to Count de Beaufort by the Society for the Aid of the Mutilated Poor for the best display of artificial limbs. Among the exhibits was a carpenter who had artificial arms, but was to be seen daily working at his trade; also a girl in same condition who sat knitting, much to the satisfaction of the spectators.

American and English Hardware.

At a recent meeting of the Manchester Scientific and Mechanical Society, a paper on "American and English Hardware," was read by Mr. F. Smith. A circular paper was read last winter by Mr. Smith, when he spoke strongly of the apathy and the want of inventive and progressive spirit which seemed to characterize the English manufacturer. Since then a number of samples of builders' hardware had been sent to him by both American and English makers, and some of these he laid before the meeting.

After describing the various examples, in which he pointed out the superiority of the American over the English article, Mr. Smith said that as he had not a personal knowledge of the rules of the various trades unions in the lock districts, he was not prepared to assess the value of the statement made by some people to the effect that much of the inferiority of the English goods was to be attributed to the absurd and anti-progressive action of the unions. But he failed to see how they could be justly held responsible for inferior castings, bad japanning, and clumsy design. For a long time our manufacturers, having had command of both their own and foreign markets, had been masters of the situation, and the result had been, first, a laxity in the supervision of the processes of manufacture. So long as the article produced by the "garret master" brought profit to his principal, the clumsy, wasteful, "rule-of-thumb" process by which it was produced was not considered, and if the late depression had given our manufacturers time to think, they might say, "Sweet are the uses of adversity."

Secondly, this abundance of work, if he was rightly informed, had led in many cases to the buying up and suppressing of improvements; and, thirdly, this great demand had led manufacturers to lose sight of the quality of their goods, and to enter into competition with each other to produce a low-priced article. After condemning the pestilent fallacy which was often raised, "our customers demand these worthless goods," Mr. Smith said that if they wanted to get an idea of how our national prosperity was influenced by the quality of the goods we manufactured they had only to consider the position held by certain firms. Why should a Chubbs lock or a Whitworth lathe command higher prices than even the good work of less known firms? Simply because the name guaranteed the quality, and when the same could be said of English goods generally we should be in a fair way to "enjoy our own again."

Another and most important factor in the sum of dead weights under which we had to struggle was our absurd patent laws, and if our legislature had set out with the intention of suppressing the inventive genius of the country they could not have succeeded more completely than they had done.

In order that we might improve our goods it seemed to him that we must discard many of our old and obsolete patterns. We must adopt a method of founding which would secure a clean casting. We must copy the Americans in the employment of mechanicians and artists, one to arrange the mechanical portions of the work and the other to design suitable and artistic forms. We must look far more to our reputation for good and honest work, and we must agitate for such an alteration of our patent laws as would place it in the power of the skillful artisan to protect the fruits of his brains at a reasonable cost.

In conclusion, he believed that there was enterprise and skill sufficient among our workmen and manufacturers to enable us to recover much of our lost ground, and the samples of English goods which he had displayed that night showed a marked advance upon those of three or four years back, while the prices were low enough to secure a sale, although in some cases a better article could be produced at the same cost.

A discussion followed the reading of the paper

The chairman observed that there had been great room for improvement in this branch of trade for the last twenty years, and Mr Smith had attributed this want of improvement to the right cause. This class of goods had not been made by mechanical men. One manufacturer got into a certain groove, and they would have kept much longer in that groove had it not been for the competition of America. He had not the slightest doubt we could produce these articles quite as cheap and as good in England as in America. In the way of castings, America could not surpass us, and it was only necessary that our manufacturers should get out of the old groove, and introduce scientific and mechanical motions into their productions to enable us to outstrip America.

Mr. Corbett also thought one great fault had been that we had got too much into one groove.

Mr. McLeod was of opinion that the existence of store factories in every town was one reason why the Americans were able to turn out such good small castings.

Mr. Heys strongly condemned the want of intelligence displayed by English founders; there were one or two firms in England who could make good castings, but they were the exception. If we could only persuade our founders that they could improve on their existing processes we should have made a great step.

A LARGE HOG.—A hog measuring 9 feet in length, 7 feet 2 inches in girth, and weighing 1,137 pounds, dressed, has been on exhibition at the Continental Market, Broadway, near 32d street. Before killing, the animal weighed 1,380 pounds. It came from Copake, Columbia County, New York.

Recent Progress in Chemistry.

Professor Dewar, F.R.S., Jacksonian Professor in the University of Cambridge, England, lately commenced a course of eight lectures on "Recent Progress in Chemistry," at the Royal Institution, London, where he fills the chair of that science. In his first lecture he dealt with the advances in chemical theory made good by the two main lines of attack on the mysteries of chemical action. These were—first, the hypothesis that matter is constituted of molecules in motion, whose structure and action may be ascertained from the investigation of sensible masses of matter; and the other or modern method, which was based solely on the two fundamental laws of physical action, namely, the conservation of energy and its general tendency towards dissipation. Thus, chemical science, so long statical, had now an extensive dynamical literature, as an admirable example of which was mentioned the lately published work of Professor Berthelot, of Paris, entitled "Essai de Mécanique Chimique, fondée sur la Thermochimie."

The lecturer then proceeded to illustrate the great advance in our knowledge and in our power of manipulation of high temperatures, referring to the immense industrial advantages derived from the introduction of Siemens' regenerator into all chemical manufactures involving the necessity of using furnaces at white heat. He proceeded to show that the recent introduction of magneto-electric machines enabled chemists to examine the interaction of bodies at temperatures far above that of any flame, which never exceeded 3,000°. With this view he showed, for the first time in public, experiments of his own. As an instance may be given his raising a carbon tube inclosed in lime by means of the Siemens electric arc to so high a temperature that the intensely heated part of the tube became changed into graphite, and by passing a mixture of equal volumes of hydrogen and nitrogen through this tube he formed prussic (hydrocyanic) acid by the direct union of carbon, hydrogen, and nitrogen. He thus proved that this exceptional chemical combination is not brought about by any occult electrical effect caused during the transit of the electricity in the arc, but that it is the result of the exceptionally high temperature of the carbon in presence of the gases. The old doctrine of chemical affinity had, in fact, been so far modified as to accord with a mechanical definition, which might be thus formulated: That if two or more compound bodies are capable of reacting chemically to form new substances, then that substance will be formed which, *par excellence*, is attended with the greatest dissipation of energy—*i. e.*, with the greatest evolution of heat.

Further experimental illustrations were given of apparent anomalies in chemical decompositions brought about by the passage of electric currents through fluids. Thus it was publicly shown for the first time that acidulated water, which is readily decomposed into hydrogen and oxygen by the current of a single pair of voltaic cells, was yet seemingly quite unattacked by the passage of the powerful intermittent current of De Meritens' magneto machine, which has a power of, say, 50 cells of Grove's battery. This, it was explained, was due to the superposition of alternate layers of hydrogen and oxygen at the poles something like 300 times every second under the most favorable conditions for chemical recombination. The apparent absence of decomposition could only be explained by the constant interchange of decomposition and recomposition. This was demonstrated by the use of the telephone, which revealed a rapid intermittent current passing through the cell, and further by the continuous rise in temperature of the contents of the cell. The lecturer proceeded to deal with the allotropic modifications of bodies, which branch of the subject he proposes to continue in his next lecture.

Strikes in Massachusetts.

The Eleventh Annual Report of the Massachusetts Bureau of Statistics of Labor, recently presented to the State Senate, contains an account of all the strikes which have occurred during the past fifty years. The total number of strikes and lockouts included in this record is 159. Of these 35 occurred in Boston and its annexes, 14 in Lynn, 10 in Lowell, 9 in North Adams, 8 in Fall River, 4 each in Worcester, Chicopee, and Marlborough; 3 each in Taunton, Natick, and Blackstone, and the remainder scattering through 41 towns. The noticeable facts are brought out that 76 of these strikes were effected chiefly by workmen of foreign birth, and that of these 159 strikes 50 were among textile factory operatives, 34 in shoe factories, and 10 among builders, while the remainder were distributed in small numbers among 25 industries. More than two thirds of the strikes, 109, were unsuccessful. Only 18 are recorded as wholly successful, 6 as partly successful, 16 as compromised, and the result of 9 is unknown. In respect to the causes of strikes, 118 were to secure better wages, 24 to secure shorter days, 9 to enforce trades union rules, 5 to resist employers' rules, and three against the introduction of machinery. The moral of these statistics is pithily presented in three conclusions, namely: "Strikes generally prove powerless to benefit the condition of the wages class; they tend to deprive the strikers of work; they lead to improvidence, and are demoralizing in their effect upon the working man." Reference is made to the strikes in Great Britain and Ireland during 1877–78. They aggregate 468, of which less than 20 were successful and only about 30 were settled by compromise.

MALLEABLE BRONZE.—M. Dronier has patented in Germany a process for rendering bronze as malleable as copper. About 1 per cent of mercury is added to the tin in a warm state, and this is then mixed with the melted copper.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 30,000 copies every weekly issue.

NEW BOOKS AND PUBLICATIONS.

CIVILIZATION: IS ITS CAUSE NATURAL OR SUPERNATURAL? Philadelphia: Chas. H. Marot. 8vo, pp. 140.

The author describes himself as a wayfarer in search of the truth, but it is very clear that he had made up his mind on that score long before he began these sermon-like chapters. He holds the origin of civilization to be supernatural, and pronounces the theory of evolution a dream. Christianity, as popularly taught, he describes as no better than Darwinism; but holds, notwithstanding, that true Christianity is the sole foundation of human progress.

MINES OF MAINE, 1879–80. By F. L. Bartlett, State Assayer. Portland: B. Thurston & Co. Price 25 cents.

Describes the present condition and future prospects of the mines of Maine. Four years ago such a book would have been an impossibility, for there were then no developed mines in Maine. Now there are half a hundred in full operation, yielding gold, silver, and copper. Tin, zinc, arsenic, iron, nickel, and cobalt are also found. There is besides an abundance of non-metallic minerals of value; so that Maine promises soon to take rank among our great mining States. Mr. Bartlett's well made little book will be likely to attract much attention to these long-neglected sources of wealth.

REVISTA CIENTIFICA MEXICANA. Tomo I., Num. 1. Mexico, Diciembre de 1879.

We have here the first number of a New Mexican publication which gives promise of being a valuable addition to the already large list of journals devoted to general science. It contains an illustrated article on the "Different Species of Maguey (Agave) which are cultivated on the Plains of Apam and in the District of Cholula," by Professor Ignacio Blasquez; on the Aneroid Barometer, by Sr. Miguel Perez; on the Sierra Mojada," by Sr. Antonio G. Cubas; on the "Ores of Bismuth of Mexico," by Professor Mariano Barcena, and on "Eruptive Porphyries," by the same; articles on the "Weather" and on "Geography," and various shorter scientific notes. In size the journal is quarto; the paper is good, the typography excellent, the articles are well written, and the editors have our best wishes for the success of their venture.

SALISBURY'S NEW PHYSICAL SIGN OF SYPHILIS. By Ephraim Cutter, M.D. Reprinted from the *American Journal of Dental Science*. 12mo., paper, pp. 12.

A verification of Dr. Salisbury's discovery of the fungoid origin of syphilis.

A TREATISE ON THE HORSE AND HIS DISEASES. By B. J. Kendall. Enosburg Falls, Vt.: J. B. Kendall & Co. 16mo, paper, pp. 89.

Contains an "Index of diseases," with directions for treatment, a list of drugs used by farriers, and a large number of recipes, etc.

RELATIONS OF EDUCATION AND INDUSTRY TO CRIME AND PAUPERISM. By Henry W. Lord. Lansing, Mich: W. S. George & Co.

This is an address by the Secretary of the Michigan State Board of Charities to the Michigan Superintendents of the Poor in their sixth annual convention. Mr. Lord takes the ground that idleness is more demoralizing than ignorance, and supports it with a sufficient array of fact and logic to justify his opposition to the provision of the Michigan constitution forbidding the teaching of mechanical trades in the State prison.

THE FRANCO-AMERICAN TREATY OF COMMERCE. Pamphlets by Leon Chotteau. New York and Paris.

1. Reports and resolutions relative to a treaty of commerce between the United States and France, adopted in the Chambers of Commerce of the United States and France. 2. Report by Leon Chotteau, delegate of the French committee, of his two campaigns in the United States to secure a lowering of the customs tariffs of France and America, with an introduction by the Secretary of the French Committee, Auguste Desmolins. 3. Translation of "My two Campaigns."

RECENT GOVERNMENT REPORTS. United States. Washington: Government Printing Office.

United States Commission of Fish and Fisheries, Part V. Report of the Commission for 1877. Annual Report of the Secretary of the Treasury on the State of the Finances for the year 1879. Annual Report of the Director of the Mint for 1879. Statistical Abstract of the United States, first number, 1878, Bureau of Statistics. Annual Report of the Chief of the Bureau of Statistics for 1879. Quarterly Report of the Bureau of Statistics relative to imports, exports, immigration, and navigation, to June 30, 1879. Annual Report of the Operations of the United States Life Saving Service for 1878.

REPORT ON EXPERIMENTS IN BOILER BRACING. U.S. Navy Department, Bureau of Steam Navigation. Washington: Government Print.

Contains plates, tables, etc., with a short résumé of the work and results of a series of test experiments to determine the value and resistance of screw stay bolts for boilers under different conditions, using iron, steel, and copper plates of different thicknesses, etc. Bolts not riveted drew out at an average strain of 32,765 lb.; those riveted with the ordinary low conical head required an average strain of 35,083 lb. to draw them through the plate, the rivet head giving an additional strength of 2,318 lb. to a 1 inch stay bolt. The gain in favor of the button head bolt over the ordinary conical head ranged from 23 to 36 per cent.

THE NEW DEPARTURE IN THE COMMON SCHOOLS OF QUINCY. By Charles F. Adams, Jr. Boston: Estes & Lauriat. Price 25 cents.

Contains three papers: 1. The Public Library and the Public Schools; 2. Fiction in Public Libraries and Educational Catalogues; 3. The New Departure in the Common Schools of Quincy, Mass. The new departure is in a direction which the SCIENTIFIC AMERICAN has long advocated, and the results are of such importance as to call for a fuller consideration than there is space for here.

VAN NOSTRAND'S SCIENCE SERIES. New York: D. Van Nostrand. Price 50 cents.

The recent addition to this series of reprints are as follows: No. 47. Linkages; the different forms and uses of Articulated Links; by J. D. C. DeRoos. No. 48. Theory of Solid and Braced Elastic Arches, applied to arch bridges and roofs in iron, wood, concrete, or other material; Graphical Analysis; by Wm. Cain, C.E. No. 49. On the Motion of a Solid in a Fluid, and the Vibration of Liquid Spheroids; by Thos. Craig, Ph.D.

HOW AND WHEN THE WORLD WILL END. By Rev. Joseph Wild, D.D. New York: James Huggins, 372 Pearl street.

A course of sermons delivered in a popular church in Brooklyn, the title of the book being that of the last discourse. The entire series is remarkable for the evidence it furnishes of the survival of a phase of culture that most men imagine to have long since passed away.

THE WORLD'S TIME.

A table showing equivalent local time every ten minutes during the day at prominent cities in the Eastern and the Western Hemisphere. Issued by the Baltimore and Ohio Railroad Company, 315 Broadway, N.Y.

VAN NOSTRAND'S ENGINEERING MAGAZINE. Volume XXI. July to December, 1879. New York. D. Van Nostrand.

The bound volumes of this well conducted magazine include a wide range of original and selected articles of permanent value to engineers.

REPORT OF PROFESSOR SPENCER F. BAIRD, SECRETARY OF THE SMITHSONIAN INSTITUTION, FOR THE YEAR 1878. Washington: Government Printing Office.

THE SMITHSONIAN INSTITUTION. JOURNALS OF THE BOARD OF REGENTS, REPORTS OF COMMITTEES, STATISTICS, ETC. Edited by Wm. J. Rhees. Washington: The Smithsonian Institution.

A documentary history of the origin and progress of the Smithsonian Institution, with collateral matter relative to its officers and their work.

THE SCIENTIFIC WRITINGS OF JAMES SMITHSON. Edited by Wm. J. Rhees. Washington. The Smithsonian Institution.

Embraces twenty-seven papers contributed by the founder of the Smithsonian Institution to scientific periodicals between 1791 and 1825; with reviews of the scientific character of Mr. Smithson's writings by Professor W. R. Johnson and J. R. M. D. Irby.

BOLETIN DE LA SOCIEDAD DE GEOGRAFIA Y ESTADISTICA DE LA REPUBLICA MEXICANA. Tomo IV. Nos. 6 and 7. Mexico, 1879.

The present double number of the Mexican Geographical Society's Bulletin, which has just come to hand, is mainly taken up with orations delivered by different members on the occasions of the two sessions held in honor of M. Thiers and of Father Secchi. The scientific paper in this issue is by Sr. V. Reyes, and entitled Statistico-Geographical Teachings as to mortality in the State of Morelos. This article, which must prove of considerable local interest and value, is illustrated with well executed colored charts showing the percentages of death in the different municipalities of the State from various prominent diseases. As with former numbers of this Society's publications, the general make up of the Bulletin is most excellent, and the taste displayed in the typography reflects great credit on the editors and printers.

PROTECTION OF FORESTS A NECESSITY. By S. v. Dorrien. New York: B. Westermann & Co. Paper, pp. 33.

Discusses the devastation of forests in Europe and the lessons learned therefrom, and argues that the protection of forests is a matter of immediate serious solicitude, the existence of forests being absolutely necessary to our national prosperity and life.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. B. W. asks: Would there be danger of springing or breaking a circular or crescent saw with a press gummer, or would it be safer to use an emery wheel? A. We think it would be safer to use an emery wheel.

(2) W. H. C. asks: (1) In using insulated wire for secondary coil, in that described in your SUPPLEMENT, No. 161, how many layers are necessary to make a spark of about one inch? A. About 30. 2. Would not the extra current and its effects be increased if there were more layers (than two) in the primary? A. Not seriously. 3. Will not a carbon button pressed by a platinum tipped screw make a good commutator? A. No; the carbon will soon burn out. 4. What mixture is used on a copper disk for engraving glass? A. Emery and oil.

(3) F. F. writes: I am replating spoons which have been in use and become badly scratched. How can the surface be made smooth again most expeditiously? A. Use emery wheels of different forms and grades of fineness. 2. How is the fine polish seen on new work obtained? A. By burnishing.

(4) C. M. writes: In Vol. xli., No. 23, page 391, SCIENTIFIC AMERICAN, near the bottom of right hand column, I find this: "The concrete is composed of 3 parts sand and gravel as found in the river, 3 parts broken stone, and 1½ barrels Rosendale cement." In this case is the 1½ barrels taken as a unit? And is the composition made up of 1½ barrels cement; 3x1½, that is, 4½ barrels of broken stone; 5x1½, that is, 7½ barrels sand and gravel? When parts are spoken of, is weight or measure intended? When the expression parts is used, as in parts of a compound, parts of an estate, is anything definite said unless a definite unit is given? A. The constituents of concrete mixtures are generally measured. In compositions of matter, when parts are mentioned without reference to a definite unit, weights are usually implied. 2. What is the composition of the potato flour spoken of in the No. 5, present volume, page 73, as being extensively used for sizing and other purposes? A.

Composition of	Newly dug potatoes	Potatoes dried at 212° Fah.
Water	75·1 per cent.	
Starch	21·0 "	84·3
Albumen	2·3 "	9·3
Salts	1·0 "	4·1
Cellulose	0·4 "	1·7
Fatty matters	0·2 "	0·8
	100	100 (Wagner)

3. What is the composition of the thick and heavy fluid sold by the grocers under the name of golden sirup—it is retailed at about 80 cents per gallon? A. An aqueous solution of cane and inverted sugar and glucose, with a small quantity of sugar impurities.

(5) F. A. W. asks: Is there any way of cutting China or porcelain (vases, for instance) so as to leave a comparatively smooth edge to cut? I have a valuable pair of vases, the top edges of which are badly broken, and I desire to cut the flaring tops off, leaving a straight neck. Can you give me a simple way of cutting it? A. Place on a mandrel in a lathe a thin disk of copper or iron 3 inches in diameter. Supply it with rather fine emery and oil, and while revolving it at a speed of 400 or 500 revolutions per minute, hold the vase against the periphery of the disk. The disk should be often supplied with emery and oil.

(6) C. A. B. asks how an egg (common hen's egg) can be put in a bottle, whose neck is smaller than the egg, and have the egg in perfect shape in the bottle. A. Soften the shell with acetic acid. It may subsequently be hardened by means of lime water.

(7) M. S. asks how the crystals on tin plate are got. I can bring out crystals with acid in the common way, or I can fuse the tin and cool by dashing cold water on it, then applying the acid. The first brings out a large coarse crystal, the second a small square star shape pattern. What I wish is different; it is called acid crystals, to distinguish from the other water crystals. It comes out equally brilliant on each side, as if the whole sheet was dipped in acid. Have tried nitric, muriatic, and sulphuric acids, both with salt and sal ammoniac, but without the required effect. A. Dip the warm plate in nitro-muriatic acid diluted with 2 volumes of soft water just long enough to develop the larger figures; then immediately plunge into a large quantity of cold water, after which dip in boiling water, which on removal will cause the plate to dry spontaneously. Lacquer immediately. A similar result is obtained by exposing the plate as it comes from the tin bath, and while the metal is still in a semi-fused condition, to jets of cold air for a few moments.

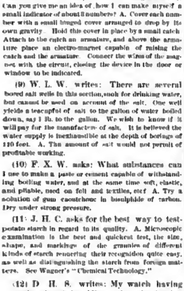
(8) C. A. R. writes: I am putting up electric bells in my house, and the ideas I wish to obtain are these: 1. What kind of battery shall I use in preference to any other? I mean, of course, among the constant condensing. A. The gravity. 2. Which battery would give the strongest current: 2 Leclanche cells, 1½ pints, 3d size, or 2 Callaud, such as are used in the telegraph offices; and which one of the two would last the longest? A. The Leclanche cells. 3. Will 3 cells of the first battery, or two of the last, be sufficient to work the bells? The wire I have is about No. 24, and the longest stretch from battery to push button and back is about twice 40 or 50 feet. A. Yes, but No. 18 wire would be rather better. 4. What number of wire is generally used for the magnet of house bells, and that of the connections from battery to button? A. Nos. 18 to 24. 5. Can Leclanche cells, I mean the porous cups, be refilled so as to possess the same power as when new? A. Yes. 6. If so, what is the best way to clean them? A. Soak them in warm water. 7. Must the oxide of manganese be pure, or is it better impure? Should it be powdered fine or coarse (like cracked corn)? A. It should be pure and granulated, or coarsely powdered. 8. Are the zinc rods better when amalgamated or not? Must they have a smooth or rough surface? A. They are more easily cleaned if smooth. They should be amalgamated. 9. Can you give me an idea of how I can make myself a small indicator of about 8 numbers? A. Cover each number with a small hinged cover arranged to drop by its own gravity. Hold this cover in place by a small catch. Attach to the catch an armature, and above the armature place an electro-magnet capable of raising the catch and the armature. Connect the wires of the magnet with the circuit, closing the device in the door or window to be indicated.

(9) W. L. W. writes: There are several bored salt wells in this section, such for drinking water, but cannot be used on account of the salt. One well yields a teacupful of salt to the gallon of water boiled down, say 1 lb. to the gallon. We wish to know if it will pay for the manufacture of salt. It is believed the water supply is inexhaustible at the depth of borings of 110 feet. A. The amount of salt would not permit of profitable working.

(10) F. X. W. asks: What substances can I use to make a paste or cement capable of withstanding boiling water, and at the same time soft, elastic, and pliable, used on felt and textiles, etc? A. Try a solution of gum caoutchouc in bisulphide of carbon. Dry under strong pressure.

(11) J. H. C. asks for the best way to test potato starch in regard to its quality. A. Microscopic examination is the best and quickest test, the size, shape, and markings of the granules of different kinds of starch rendering their recognition quite easy, as well as distinguishing the starch from foreign matters. See Wagner's "Chemical Technology."

(12) D. H. S. writes: My watch having stopped on the 16th day of Nov., and no other timepiece being at hand, I obtained time by the following process:



In the evening a board having a straight edge was leaned against the cabin and aimed at the north star. A plumb line was then suspended from the edge of the board. From the almanac I learned that upon the 17th the sun would fall on noon mark at 11:45. The instant the shadow of edge of board coincided with plumb line I set my watch at the time mentioned, 11:45. My companions said the time was too slow, and so it seemed to me. Can the true mean time be obtained in the manner described above, and if not, what corrections are necessary? A. Your failure to get a true meridian line was owing to the fact that the pole star is only on the meridian twice in 24 hours, and these times change from day to day, by reason of the difference of sidereal time given by the apparent diurnal motion of the stars and solar time given by the apparent daily motion of the sun. The pole star is twice daily at its extreme eastern and western elongations, 1½ degrees from the true north. He could have obtained his meridian line and by it have set his watch as follows: Set up a stick, A B, and on its end fasten a piece of tin perforated with a hole. Let the string of a plumb bob hang through the center of this hole, and thus get a point in the vertical, marked V in the diagram. About 8 A.M. mark the center of the image of the hole at D, then with the line, A D, as a radius, describe an arc of a circle, and when in the afternoon the image of the hole falls on this line, as at E mark, then the line, N S, which bisects the angle, D A E, is the true meridian.

(13) W. M. asks what the ingredients are used by Cooper and several other glue manufacturers to make common glue white. A. Use fine, clear stock, a little alum, steam heat, and vacuum boilers.

(14) W. C. writes: 1. The recipe for violet copying ink which you give in your SUPPLEMENT, No. 157, p. 2498, is not intelligible. Please inform me what the symbols 5B, BR, etc., mean. A. The terms are those used by dealers to designate particular shades of color. 2. Please inform me whether you have published a recipe for making the copying pad which is so much used. A. See p. 835, SCIENTIFIC AMERICAN, Vol. 41.

(15) G. H. J. asks: What solution of silver is precipitated in a granular metallic form, by immersing in it a plate of copper? A. Sulphate or nitrate.

(16) H. H. asks for a good receipt for dressing for shoes, such as is sold in bottles under title of "French dressing" for ladies' or misses' shoes. A. Logwood extract, 6 oz., dissolve in soft water 1 gallon; borax, 6 oz., dissolve in soft water 1 gallon, and add 1½ oz. shellac, boil to dissolve; bichromate of potash ½ oz., dissolve in soft water ½ pint, and add 8 oz. ammonia water. Mix all together.

(17) W. B. P. asks: What material can I fortify with, in making a copper plate stencil, by allowing nitric acid to "eat out" the letters? A. The etching ground commonly used is prepared by melting together equal parts of asphaltum, Burgundy pitch, and beeswax, stir to incorporate. If the ground is brittle, use more beeswax; if it drags, more asphaltum.

(18) D. C. M.—Consult Blodgett's "Climatology," Buchan's "Handbook of Meteorology," Dove's "Law of Storms," Espy's "Philosophy of Storms," Herschel's "Meteorology," Kaemtz's "Meteorology," Lardner's "Meteorology," Morris' "Meteorology," Jenkens' "Use of Barometers," etc.

(19) B. S. writes: I made a copying pad according to directions in your paper, and find it works well, except that the material wastes away very rapidly in the cleaning after use. How could I obviate this difficulty? A. Use a very little warm water instead of cold. The gradual wasting is unavoidable.

(20) J. C. L. asks: How shall I proceed to polish copallite to properly show the insects therein? A. Cut it with a fine saw, and polish with tripoli and a little oil, applied on kid or chamois skin.

(21) R. W. H. asks for a receipt for dyeing billiard balls? A. Black.—Boil in a strong aqueous solution of logwood extract, and then immerse in acetate of iron solution; repeat if necessary. Blue.—Immerse for some time in a dilute aqueous solution of sulphate of indigo partially saturated with potash. Green.—Dip the blued ivory in tin liquor for a few minutes, then in a hot saturated aqueous solution of fustic; or boil the iron in a solution of verdigris in vinegar. Yellow.—Use the tin mordant and a hot strained decoction of fustic. Red.—Use tin mordant, and steep in a decoction of Brazil wood or cochineal or both. Lac, under similar circumstances, produces scarlet.

(22) S. G. writes: 1. I am about making an engine to run a scroll saw. It requires about the same power to run the saw as a sewing machine. What would be the proper dimensions for the engine? A. About as small as you can make, say 1 inch cylinder by 2 or 3 inch stroke. 2. Would Babbitt metal be hard enough to make the cylinder? If not, is there any metal softer than iron that would do? A. Yes, but it would wear fast. Use a piece of mandrel drawn brass tubing.

(23) G. A. C. asks: 1. If a steam fire engine will throw a stream a distance of 100 feet through 200 feet of hose, the engine running at 150 revolutions a minute, will it throw as far through 1,000 feet of hose, the engine still making 150 revolutions per minute? A. Yes, but it will require much more engine power to overcome the friction of the water in the 800 additional feet of hose. 2. Please name a good work on the steam engine for one who is not a professional engineer. A. Rowne's "Catechism of the Steam Engine."

(24) W. H. asks: What is the best self-feeder for low pressure steam boiler (up to 10 lb.)? A. The old Watt water column and float.

(25) P. V. H. writes: I think that the trouble complained of by your correspondent W. H., 6 query, page 123, in your number of February 2 (received to-day), will be corrected, if he brings his return pipe for condensed water from radiators into the boiler below the level of the water. The noises made are due to the struggles between the steam and water, when this pipe is open sometimes to steam, making varying pressure as the quantity of condensed water varies. Having suffered myself from this trouble, I completely corrected it in this way. There is never the least noise now.

(26) S. G. M. asks: 1. Can you give me a description of the Blake transmitter? A. See p. 274, Vol. 40, SCIENTIFIC AMERICAN. 2. Will the Lyons transmitter (described in SUPPLEMENT No. 163) work without an induction coil? A. No.

(27) R. H. J. writes: I have a new steam kettle, cast iron, porcelain lined, which is supplied with steam by a ½ inch pipe; it is 10 feet from the boiler, and yet I can scarcely make water boil in it with 30 lb. of steam; what is the matter? A. You send insufficient data, but a few general remarks may throw some light on the trouble. To raise water from mean temperature (60° Fah.) to boiling, it requires about one fifth its weight in steam to do it, making no allowance for loss of heat by radiation. To evaporate all the water from a steam kettle it will require at least its own (the water's) weight of steam. The waste or return water from a steam kettle should not be taken to the same steam trap as the water from the heating apparatus, for the great shrinkage, that is, rapid condensation due to the steam coming in contact with a large body of water through the sides of the kettle, will cause the condensed water to back up and fill the steam space. Theoretically it will take about 8¼ minutes to boil a cubic foot of water, assuming all the steam that can pass through a ½ inch pipe at 30 lb. pressure can be utilized in the same time. Thus, if you have a 75 gallon kettle it will take 85 minutes to heat all the water to 212° Fah. with steam through a ½ inch pipe, making no allowance for transmission through the iron, the slowness of convection of the water, and loss by radiation, and this under the most favorable circumstances of piping and trapping. When ebullition begins all the water in a kettle has not yet reached 212°. The baking of about ¼ of an inch of mush on the bottom of a kettle, for the want of stirring when the meal was first put in, prevented the proper cooking of the food for 10 hours, and eventually it had to be removed to another and clean kettle.

(28) R. D. G. asks: 1. Do you know of any gear cutters which can be attached to a lathe? A. There are gear cutters made to be attached to a lathe for cutting small wheels. 2. I would like to know the easiest method for getting the diameter of a wheel when the pitch and number of cogs are given. A. Multiply the pitch by the number of teeth; the product is the circumference of the wheel at the pitch line.

(29) H. H. & Co., referring to our reply to F. A. S. on p. 124 current volume of SCIENTIFIC AMERICAN, write: The Bessemer steel from which railway rails are made contains from 35-100 to 45-100 of one per cent of carbon, and if mould boards and scraper bottoms are made of such steel, they can be hardened. These articles are made every day by all steel works from such material when asked for. Of course the degree of hardness will not be equal to the special plow steels made by the crucible method. Sheet steel for shovels, spring steel for carriage springs, etc., are rolled from Bessemer ingots when buyers require a cheap article.

(30) J. R. asks for a work on steam fitting similar to Mr. Baldwin's "Hints to a young Steam Fitter." A. We do not know of a work exclusively devoted to the subject. 2. What is the best length for a tubular boiler to burn hard coal, 12 or 14 feet; and the best size tube, 3¼ or 4 inch; draught is good. A. If you use 3¼ inch tubes you can make the boiler 12 feet, but with 4 inch tubes it should not be less than 14 feet. In either case it may be made 2 feet longer with advantage.

(31) R. C. M. asks (1) for a rule for finding the horse power of engines. A. Square the diameter of the cylinder, multiply the product by 0·7854. Multiply this product by the average pressure of steam per square inch on the piston, and this result by the number of feet the piston travels per minute, and divide by 33,000, the quotient is the horse power. 2. What is the rule for finding the horse power of a tubular boiler? A. For a tubular boiler allow 15 to 17 feet heating surface for each horse power. 3. What is the name of the newest and best book on the blast furnace? A. Schinz on "The Action of the Blast Furnace."

(32) J. L. writes: 1. In your issue of February 7, 1880, question No. 1, you advise hydraulic cement properly mixed to stop leaks in legs of locomotive boiler corroded by salt or lye. How is it to be mixed? Are you not advising the party to get up a first class explosion; one that will make that boiler throw a somersault similar to a locomotive boiler which exploded inside of Rogers' Works in Paterson, N. J., in 1862? A. Mixed like ordinary hydraulic lime mortar, small pieces of broken bricks put on to fill up space, there is no danger if the top is kept properly below the fire line. It has been used successfully in a number of cases. 2. What do you consider the best packing or joint for use between cast iron steam dome and top of portable boiler? A rust joint or soft cement composed of lead, oil, and borings as per "Wrinkles and Recipes," pages 125 and 126? A. If the surfaces are true and faced, use the soft cement; if rough and untrue, make a rust joint.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. F. B.—It is pyrolusite—binoxide of manganese. The powdered mineral is commercially known as manganese, also as black oxide of manganese. It is largely used in the manufacture of bleaching powder or chloride of lime (calcium hypochlorite) and in glass making.—S. D.—We cannot judge fairly of the value of your water from so small a sample. The cost of a full quantitative analysis of a mineral water would be about $100.—M. M.—The ore is undoubtedly rich in silver; it is free milling.—J. F. S.—The sample of boiler incrustation consists chiefly of sulphate and carbonate of lime, oxide of iron, silica, alumina, and organic (carbonaceous) matter. The use of small quantities of tannate of soda has been found efficacious in preventing the formation of hard incrustations. Filter the water and use the blowout frequently.—W. S. B.—Crystals of rose and amethystine quartz, sometimes used in jewelry. They are of little value. No. 2. It is chlorite in quartz, possibly auriferous.—L. M. C.—They consist chiefly of carbonate of lime with small quantities of clay, quartz, sulphide of iron, and lime phosphate.

English Patents Issued to Americans.

From February 13 to February 17, inclusive.

Anæsthetic compound, T. A. Edison, Menlo Park, N. J.
Bookstand, F. G. Johnson, Brooklyn, N. Y.
Dyeing, G. G. Smith, St. Albans, Vt.
Electric lamp, T. A. Edison, Menlo Park, N. J.
Electric light, T. A. Edison, Menlo Park, N. J.
Flue cleaner, R. Atherton et al., Paterson, N. J.
Gas manufacture of, H. Y. Attrill et al., New York city.
Oil still, E. Watson, Buffalo, N. Y.
Printing calico, F. Bayliss et al., New York city.
Railroad rails, A. J. Gustin, Boston, Mass.
Refrigerating apparatus, S. B. Hunt et al., N. Y. city.
Telegraph, electric, B. Thompson et al., Toledo, Ohio.
Wood-cutting tool, F. Hanson, Hollis, Me.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 17, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Gas meters, automatic safety valve and seal lock for, M. Shea ... 224,736
Gate, W. Butterworth ... 224,645
Glassware, manufacture of, T. C. Peters ... 224,324
Glazed structure, W. E. Rendle ... 224,479
Grain binder, C. L. Travis ... 224,744
Grapes, etc., machine for expressing the juice from, P. M. J. Chavanelle ... 224,440
Grinding mill, L. Durand ... 224,654
Harp, C. E. Holtz ... 224,500
Harrow, J. F. Moon ... 224,691
Harrow, sulky, W. W. Cook ... 224,640
Harrow teeth, machine for making, H. J. Gage et al ... 224,305
Harrow tooth, P. A. Peer ... 224,722
Hat and other head coverings, celluloid, G. H. Trostel ... 224,345
Hay loader, E. Bollinger ... 224,614
Hay press, B. Tompkins ... 224,343
Hay rake, revolving, J. B. Oberholtzer ... 224,718
Heating railway and other carriages, A. Ancelin ... 224,365
Heel trimming machine, H. A. Henderson ... 224,666
Hitching device, horse, R. Soldiers ... 224,601
Honey extractor, centrifugal, J. W. & C. M. Cole ... 224,654
Hoof protector, J. D. Lewis ... 224,734
Horse detacher, J. B. Shaw ... 224,5[illegible]
Hose band, O. T. Earle ... 224,386
Hose connection and sprinkler, combined, G. R. Burton ... 224,501
Hose nozzle, L. W. McGaffey (r) ... 9,101
Hydraulic press attachment, J. W. Jones ... 224,686
Knitting machine needles, manufacture of, Jackman & Flanders ... 224,341
Knitting machine needles, manufacture of latches for, Jackman & Flanders ... 224,341
Lamp, J. Kintz ... 224,201
Lamp, hanging, T. D. Hotchkiss ... 224,339
Lamps, manufacture of peg, J. Dalzell ... 224,319
Lantern, T. Langston ... 224,708
Lead fumes, refining waste, G. T. Lewis ... 224,348
Lock nut, H. A. Harvey ... 224,201
Locomotive, coal burning, W. Buchanan et al ... 224,640
Loom pattern chain, M. Lindner ... 224,560
Magneto-electric machine, E. Burgin ... 224,642
Malt extract, J. Carnrick (r) ... 9,075
Malting apparatus, A. Marbeau ... 224,354
Mashing and mixing brewer's mash, machine for, C. Stoll (r) ... 9,080
Meat, curing and canning sausage, H. Verhage ... 224,505
Meat press, G. T. Bassett ... 224,629
Microphone, E. Berliner ... 224,323
Middlings purifier, J. M. Ludwig ... 224,705
Middlings purifier, T. B. Osborne ... 224,319
Moulding in sand, machine for, Aikin & Drummond ... 224,570
Moulding picture frame, W. H. Grubbs ... 224,590
Motive power, production of, T. M. Fell ... 224,620
Mower, lawn, W. C. Farnum ... 224,503
Mower, lawn, T. D. Marsh ... 224,706
Music sheet for mechanical musical instruments, E. P. Needham ... 224,715
Music stand, portable, A. Hawes ... 224,097
Musical instrument, mechanical, E. P. & O. H. Needham ... 224,716
Nut lock, J. D. Beech, Jr. ... 224,630
Packing, hydraulic piston, G. Johnson ... 224,690
Pantaloon garment, Schilling & Florsheim ... 224,520
Paper holder, L. J. Labounty ... 224,547
Paper pulp, wood grinder for making, S. M. Allen ... 224,623
Pawl and ratchet device, W. C. Farnum ... 224,321
Picker leg, J. N. Jones ... 224,545
Pigments from lead sulphurets, making white, G. T. Lewis ... 224,349
Pile, composite, H. Case ... 224,646
Pill making machine, J. A. Whitney ... 224,566
Pipe clamp for oil wells, etc., C. Hume ... 224,502
Planing machine, metal, S. E. Hildreth ... 224,284
Planter, corn, J. F. Hudson ... 224,394
Plow, G. Watt ... 224,730
Plow, R. W. Whitehurst ... 224,730
Plow, corn, P. Brennan ... 224,689
Plow, sulky, J. F. Mann ... 224,712
Pressure regulator, fluid, R. Bocklen ... 224,275
Printing machine beds, inking plates to, S. Crump ... 224,650
Printing machine, ribbon paper, T. G. Hoster ... 224,287
Printing, preparing autographic stencils for, T. A. Edison ... 224,665
Pulley, stop, A. S. Dickinson ... 224,662
Pump, G. H. Fell ... 224,669
Pump, lifting and force, E. Barnes ... 224,309
Railway column, elevated, F. A. Williams ... 224,567, 224,568
Railway frogs, die for the manufacture of cups for, D. C. Pierce ... 224,607
Railway signaling apparatus, Ireland & McDonald ... 224,682
Refrigerating apparatus, T. C. Eastman ... 224,321
Rein holder, W. J. Morgan ... 224,711
Roost, self-adjusting anti-sparrow, T. B. Daughert ... 224,520
Ribbon holder, L. M. Chipley ... 224,391
Rocking chair, folding, C. D. Hyde ... 224,683
Rolling chisels, machine for, G. Farr ... 224,530
Roof composition, D. D. Pennoyer ... 224,605
Saddle tree fork, G. A. Mittendorf ... 224,700
Sash window, A. Friedrich ... 224,675
Saw mill head block, J. Cain (r) ... 9,074
Saw mill head block, J. Hubbell (r) ... 9,076
Saw mills, feed and gig works for, J. H. Watson ... 224,149
Screw machines, cutting-off tool for metal, A. Johnston ... 224,543
Screws, machine for making, machine, F. Curtis (r) ... 9,086
Sectional boiler, M. W. Hazelton ... 224,685
Sewing machine, S. M. Tyler (r) ... 9,069
Sewing machine hand wheel bearing, Miller & Diehl ... 224,710
Sewing machine take-up, G. W. Baker ... 224,372
Sewing machines, device for guiding and feeding straw braid, H. Plummer (r) ... 9,082
Sewing machines, feeding device for straw braid, H. Plummer (r) ... 9,083
Shade roller, spring, D. E. Kempster ... 224,606
Shawl strap, J. Vose ... 224,749
Shoe, I. Hall ... 224,680
Show case, T. Vaughan ... 224,562
Shutter bower and fastener, combined, Stewart & Price ... 224,639
Shutter fastener, Tenney & Walton ... 224,610
Sieve, E. J. McGurren ... 224,295
Sled brake, L. Sted ... 224,615
Snap hook, J. K. Wightman ... 224,622
Soap, apparatus for making, B. H. Chadbourn ... 224,514
Spinning machine, Keisling & Rabb ... 224,705
Stamp, hand, G. E. Emerson ... 224,666
Stand pipe drier for shafts, C. Wright ... 224,756
Steam heater, W. C. Wren ... 224,300
Steam muffler, Campbell & Drake ... 224,644
Steam trap, T. B. & S. S. Davis ... 224,651
Steam trap, H. Mitchell ... 224,603
Stereotype and other plates, machine for shaving and cutting, W. A. Wright ... 224,758
Stone, artificial, J. P. Davis ... 224,660
Stone sawing machine, H. Young ... 224,760
Stone working, etc., boring tool for, W. Hasenaahl ... 224,530
Stove bay burner attachment, L. T. Harper ... 224,698
Stove lifter and carrier, C. K. Smith ... 224,617
Stove, steam, J. Ashcroft ... 224,625
Straining cover for milk pails, S. Jane ... 224,639
Stump puller, J. G. Tramp ... 224,749
Sugar machine, centrifugal, E. Fromann ... 224,674
Suppository mould, J. W. Soe ... 224,734
Swivel hook for tightening and connecting ropes, W. B. Skinner ... 224,738
Telegraph, underground, C. Linford ... 224,581
Telephone exchange switch, G. W. Coy ... 224,620
Telephone switch and connection, G. Westinghouse, Jr. ... 224,565
Tenoning machine, White & Kelley ... 224,752
Thill coupling, J. Fast ... 224,467
Thimble blanks of celluloid and other materials, apparatus for and process of forming, W. H. Haley ... 224,682
Ticket holder, S. Hersberg ... 224,664
Toasting iron, reversible, C. G. Stafford ... 224,749
Tobacco box, Balmer & Leidler ... 224,509
Toy, A. Dorn ... 224,285
Traction wheel, H. T. Stith ... 224,141
Truss band, M. Johnson ... 224,688, 224,604
Valve, balanced slide, J. Fish ... 224,325
Vegetable slicer, F. Berainu ... 224,621
Vehicle sand band, L. F. Bandica ... 224,641
Vehicle spring, S. A. Bailey ... 224,627
Vessels, construction of freighting, F. Imhorst ... 224,691
Vise, circular saw, J. L. Glover ... 224,678
Wagon lock, J. L. Guinn ... 224,601
Wagon reach coupling, A. Heikes ... 224,681
Waiter, H. Berry ... 224,632
Wardrobe, bedstead, and table, combined, E. J. Greek ... 224,679
Washing machine, Holloway & McLain ... 224,689
Watch case, E. C. Fitch ... 224,670
Water cooler, T. D. Mowlds ... 224,713
Water through pipes, apparatus for elevating and forcing, T. Tuly ... 224,561
Whiffletree hook, W. Freeland ... 224,673
Windmill, J. G. Baird ... 224,628
Wood cutting machine, J. H. Phipps ... 224,550
Wooden bows, machine for bending, C. Wright ... 224,757
Zithern, C. E. Holtz ... 224,535

DESIGNS.

Carpet, T. J. Stearns ... 11,634
Glass tumblers, tongs, etc., R. J. Beatty ... 11,635
Spoon and fork handles, W. S. Durgin ... 11,636

TRADE MARKS.

Cigars, Krohn, Feiss & Co ... 7,824, 7,825
Medicine for the cure of rheumatism and dyspepsia, J. Webb ... 7,826
Pencils for carpenters and draughtsmen, lead, C. H. Dudley ... 7,823
Pickles, Yarnall Brothers ... 7,831, 7,832
Stone crushers, Blake Crusher Company ... 7,827
Tobacco, cigars, cigarettes, cheroots, and snuff, smoking and chewing, F. W. Felgner & Son ... 7,828
Toilet preparations, certain, Lanman & Kemp ... 7,830
Whisky, C. Ledlard ... 7,829

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

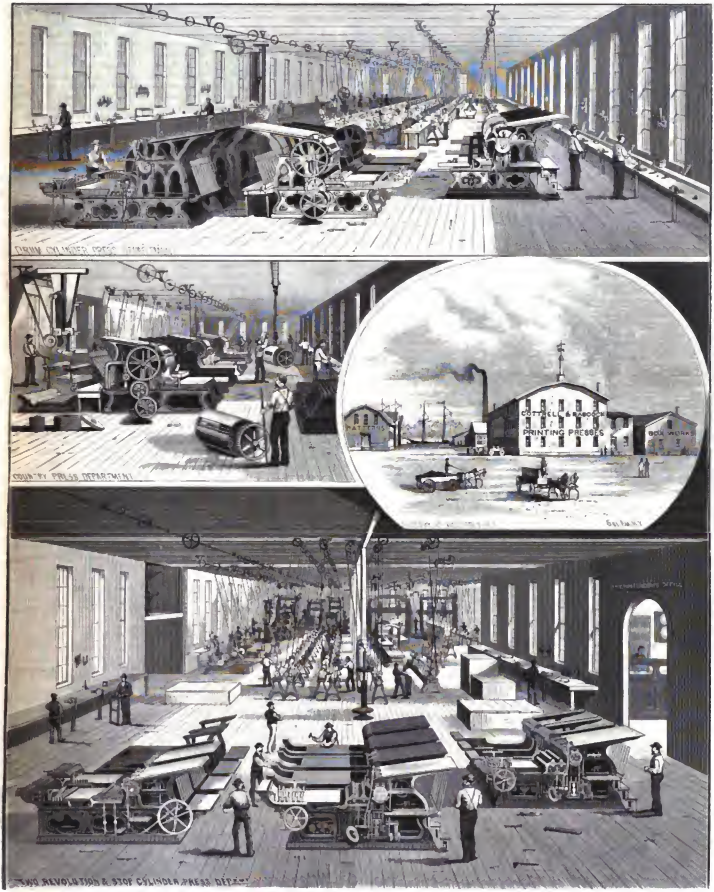
☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 13. [NEW SERIES.] NEW YORK, MARCH 27, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]



THE MANUFACTURE OF POWER PRINTING PRESSES.—WORKS OF MESSRS. COTTRELL & BABCOCK, WESTERLY, R. I.—[See page 196.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, MARCH 27, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 221,

For the Week ending March 27, 1880.

Price 10 cents. For sale by all newsdealers.

SHIP RAILWAYS FOR ISTHMUS CROSSINGS.

The superior advantages of a ship railway for the Isthmus of Darien were considered at some length in the SCIENTIFIC AMERICAN for August 2, 1879, in connection with a forcible paper on the same subject by Captain Eads. Attention was then called to the fact that this distinctively American plan of solving the isthmian difficulty had commended itself to American engineers long before the success of the Suez Canal gave a speculative impetus to canal projects for uniting the great oceans by way of Central America.

And now that M. de Lesseps is urging so vehemently his scheme for a sea-level canal at Chagres, the ship railway project has again risen to prominence. This not solely because of the theoretical favor it commands from capable engineers, but also because of the practical commercial interest called out by the bill before Congress, looking to the actual construction of a ship railway across the Isthmus, and its ultimate control by the United States.

In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT will be found an extended reply by Captain Eads to the argument of M. de Lesseps, before the House Canal Committee, in favor of the Chagres canal, and a clear statement of the advantages of a ship railway instead. Captain Eads maintained that a substantial and durable ship railway could be built at half the cost of a canal with locks, and a quarter of the cost of a tide-level canal, with a saving of from two-thirds to three-fourths the time required for constructing a canal. The railway would have the further advantage of capacity to move ships of maximum tonnage four or five times faster than would be possible in a canal, thus allowing many more ships to pass each way in a given time; while the cost of maintenance and operation would be less than with a canal. With this superior capacity for meeting the varying demands of commerce, both as to the size and the number of the vessels transferred from ocean to ocean, a ship railway can be built and operated where a canal would not be possible; and, being above ground, it is possible to estimate with great accuracy what it would cost and how long it would take to build it. A canal, on the contrary, is strictly a hydraulic construction, involving the control of water and the execution of works under water, with liability to irruptions of water, making an accurate estimate of the time and cost of construction an impossibility.

Captain Eads illustrated his plan to the House Committee by means of drawings. The proposed railway led into the water to the depth of 30 feet, along an incline having a grade of 1 in 100; a cradle being thereby submerged for the reception of the ship to be transported across the Isthmus. The railway consisted of 12 steel rails, weighing 70 lb. to the yard; the wheels under the ship's cradle being 3 feet apart and bearing a maximum pressure of 5 tons, with capacity to withstand a pressure of 20 tons. The number of rails and the great weight of the ship, he insisted, would make derailment impossible; and the great number of wheels under the cradle would so equalize the oscillation that there would be no perceptible motion in the ship's cabin. Touching ability of ships to withstand the strain of land transportation, Captain Eads said that any vessel thought capable of withstanding the gales and hurricanes of the Atlantic and Pacific oceans, was capable of being carried on this railway with absolute safety—indeed, with as much safety as a child in its mother's arms. His plan had been received with favor by Mr. E. J. Reed, the Chief Constructor of the British Navy; Mr. John Roach, Mr. Henry Steers, and a great number of the most eminent engineers of America.

As in the case of his successful improvement of the mouth of the Mississippi River, Captain Eads proposes to assume all the risk. Having demonstrated the practicability of a ship railway for the Isthmus, by transporting thereon a vessel of maximum tonnage from ocean to ocean, he asks, in the bill referred to, that the United States shall guarantee the payment of an annual interest of six per cent on the cost of construction, and acquire thereby the right to regulate the tariff of tolls.

The well earned reputation of Captain Eads as a practical and thoroughly scientific engineer, and the support he commands from engineers of high rank, furnish the highest assurance that the plan he proposes is feasible; and its manifest economy should have great weight in determining what kind of trans-isthmian route shall be adopted. If, at the cost of one canal, three or four railways of equal capacity can be built along as many different lines, it will be a queer commentary on American thrift and business capacity if M. de Lesseps persuades American capital to invest in his canal.

EVILS OF NEGLECTING COLD IN THE HEAD.

In a paper read by Dr. D. B. St. John Roosa of this city, at the recent meeting of the Medical Society of the State of New York, he stated that the most frequent origin of chronic diseases of the lachrymal passages, of the conjunctiva, and of the middle ear, is in a neglected "cold in the head." It is generally conceded that no person in perfect health, except under extraordinary circumstance, takes cold, and yet the majority of mankind have, at some time, suffered from cold in the head. The popular idea that a cold in the head is an insignificant affair is founded on the fact that most of the people recover to such an extent that they are able to go about afterward and engage in their ordinary avocations without special notice, at the time, of the consequences of the disease, which may even then be settled upon them. He believed that very many of the maladies which prevented men and women from reaching the allotted period of three score and ten have their origin in these colds, and that many serious affections which act as an impediment to the success of their victims are dated from a cold in the head.

He described the suffering incident to an acute attack of cold in the head, and of the impossibility of having repeated attacks without producing serious local changes—not only local change, but a permanent impairment of nutrition. To correct all this, special attention must be paid to individual hygiene, and if the evil consequences of neglected cold in the head were to be abolished, the abolition must come through a public sentiment properly educated upon this as upon all other sanitary questions. The family physician must warn the people everywhere, as opportunity offers, of the danger in this direction, and of the means by which it is to be avoided. The first great precaution to be taken by each individual is to keep himself in a good general condition, and to do that he must studiously avoid all that tends to disorder the skin and the functions of all the organs of the body. Children must be clothed in flannel all the year round, and must be made to know that the staples of diet are milk, bread, meat, vegetables, and fruit, and that tea, coffee, and pastry of all kinds are to be used only as the greatest of luxuries, and therefore in small quantities and at long intervals. The community can only become healthy as individuals become healthy, and all the reforms necessary to make Memphis and Granada places in which yellow fever never comes may be adopted; but if the control cannot be obtained of the bodies of, and the modes of living of the individuals in those and all other places, evils not so suddenly fatal, but none the less in the end dangerous, and all the time injurious to their well being, will certainly exist.

A PLAN TO MAKE NEW YORK A FRESH WATER PORT.

Mr. James Cochrane, "formerly of the U. S. Navy," gravely proposes to convert New York harbor into a mill pond, for the benefit of commerce and the improvement of public health.

His plan is not very coherently presented in the pamphlet he sends us, but it is possible to make out several of the changes he wishes to effect.

In the first place, he would build at the Narrows, and at Throgg's Neck, on the Sound, artificial dams with locks, which would shut out the ocean tides and convert the bay and the waters communicating therewith into a many-armed fresh water lake, with a level five or six feet above the present level of the water at high tide.

Among the benefits promised by the change are these:

The vast area of flats along the Jersey shores would be permanently flooded, putting an end to their malarious exhalations.

The depth of water could be regulated, and would be uniform, thus saving that portion of the large expenses involved in handling freight at the wharves, due to rising and falling tides.

The danger and cost of ferry bridges would be obviated, with much of the difficulty and danger now attending the navigation of ferryboats.

The water of the port would be fresh, and fatal to barnacles and ship worms, making the port a desirable one for shipping awaiting freight.

The flow of the river would be steadily toward the sea, so that the tedious anchor watch might be dispensed with.

The surplus water could be used as the source of mechanical power.

The aggregate saving promised for the plan proposed amounts to millions of dollars every year, and millions of lives in time not stated. But the greatest benefit is modestly withheld. In comparatively few years the vast areas of waste water from Newark Bay to Throgg's Neck would be filled up by river silt, and under proper cultivation would furnish all the garden truck required by the surrounding cities. The value of such reclaimed land would be enormous; while the narrow channels that would carry off the inflowing fresh water would probably be ample for the needs of all the commerce that would seek New York as an inland port.

A ZOOLOGICAL NOVELTY.

The first elephant born in this country made its appearance, March 10, in the elephant house of Cooper & Bailey's circus in Philadelphia. It was a female, 4 feet 6 inches long, 35 inches high, and weighed 213½ pounds. The event was not unexpected, though the period of gestation—twenty months and twenty days—was somewhat briefer than was anticipated.

The mother, Hebe, sometimes called "Baby," is one of the five performing elephants whose tricks have been witnessed by circus-goers in every large town in the country. She is 23 years old, weighs 8,000 pounds, and was imported from Ceylon in 1865. Her keeper suspected her condition over a year ago, called the attention of several Philadelphia scientists to the fact, and arranged for examination, which was made by Professor Joseph Leidy, of the University of Pennsylvania; Professor Penrose, of the University of Pennsylvania; Dr. Brinton, of Jefferson College; Dr. F. P. Maury (now deceased), of Jefferson College; Professor Allen, of the University of Pennsylvania; Dr. Henry Chapman (coroner's physician), of Jefferson College, and a number of other eminent physicians. It was then decided that the period of gestation would be complete about the middle of the present month. Naturally the event has not lessened the interest which physicians and naturalists have taken in the case, and it is probable that a paper on the subject will

be presented to the Academy of Natural Sciences of Philadelphia.

The mother and infant are both doing well, the latter sucking like any other mammal, folding its trunk back over its head, as described by all reputable naturalists. The birth of elephants in captivity is not an uncommon occurrence in India. Unfortunately no one appears to have been present to witness the accouchement.

CHEMICAL REPULSION.

In a paper read on the 18th of January before the Royal Society, Dr. E. J. Mills claimed to have discovered a new order of chemical phenomena, which he has provisionally designated as "chemical repulsion." If a thin layer of a solution of chloride of barium be distributed evenly between two plates of glass placed horizontally (excess being removed by pressing the plates together), and then dilute sulphuric acid be brought into contact with it through a perforation made in the upper plate, precipitation takes place and continues progressively and uniformly from the perforation as a center; forming an increasing circle, for instance, if the perforation be circular. If the sulphuric acid be introduced through two perforations in the upper plate, two circles are formed, but as their circumferences approach each other development is retarded between the perforations, the figure of advance being no longer circular, but oval, and, however long the experiment may be continued, there always remains a line of demarkation of "no chemical action" between the two figures. When there are perforations at the four points of a square and one in the center, the center circle, having, as it develops, no way of escape from the surrounding four, eventually forms a square figure bounded by repulsion lines. Dr. Mills considers that the phenomena observed afford proof of two propositions: (1) That chemical action can take place at a distance; and (2) that two or more chemical actions, identical except in position, completely exclude one another.

Statistics Versus the "Big Farm Scare."

A great deal has been said about the multiplication of big farms in this country, and doleful predictions have been uttered by those professing to believe that the United States are destined to repeat the experience of England and Ireland in the monopoly of the land by a few. That there is no real danger of such an issue is clearly shown by the following statistics, which the *Tribune* compiles from the several census reports.

In 1850 the average size of farms in the United States was 203 acres; in ten more years the average was four acres less, and at the last census a further reduction of 47 acres appeared, and farms averaged only 153 acres. The decline between 1860 and 1870 was so general that the only exceptions in all the States and Territories were—an increase in California from 466 to 482 acres, from 94 to 133 in Massachusetts, and from 25 to 30 in Utah. Prior to 1850 land monopoly had some claim to existence in California; in ten years the average size of farms was diminished by a reduction of just 4,000 acres! In Texas the reduction was in the first decade from 942 to 591 acres, and in the second to 301 acres. The next census is expected to show a further decline. Minnesota had 157 farms in 1850, 18,181 in 1860, 46,500 in 1870, and now claims more than 68,000, and her farmers are not much frightened in view of the competition of half a dozen "monster" wheat farms! There were 5,364 farms of more than 1,000 acres each in 1860; in 1870 there were only 3,720. In the same period the number from 500 to 1,000 acres declined from 20,319 to 15,873, while all the classes of smaller farms increased, the ratio of increase getting larger as the scale of size descended.

The Mind in Eclipse.

At a recent meeting of the Medico-Legal Society, in this city, Dr. George M. Beard read a paper on "The Problems of Insanity," in which he said: "It is a paradox of astronomy that the sun may best be studied during an eclipse; and in psychology the mind may be studied best when it is eclipsed.

"Insanity is a disease of degrees; there is no plain dividing line between sanity and insanity. Insanity may be divided into two kinds—intellectual insanity, embracing forms in which there are delusions, and emotional insanity, in which there are no delusions. Insanity is a barometer of civilization, and as we advance higher in the arts and sciences so will insanity become more prevalent among us. Intense application, brain work, and indoor life are the agencies which most frequently bring it about. With savages or barbarians there is little or none of it. The intellectual activity of the women of to-day is another great cause of insanity. What the mother is, so will the child be in an intenser degree.

"Insanity is increasing most perceptibly in Europe and America among the poorer classes. Civilization grinds hardest on the poor, shutting them up in close houses, with bad air and poor food, and compelling them to struggle for existence. The brain cannot always bear up under the strain, for they have few recreations and amusements which can be indulged in for the relaxation of their minds. A diagnosis in cases of insanity is most difficult. The physician must know the subject psychologically; know he thinks, what he thinks, and all about his general disposition, passions, etc. The probabilities of cure in the case of insane persons depend greatly upon the advancement of the disease when the treatment is begun. It is better if the patient can be treated out of the asylum, and if he is not confined or isolated altogether from the world, narcotics and stupefying remedies should not be used when their use can be avoided. Until a comparatively short time our inventions have tended to an increase rather than to a decrease of insanity. Of late, however, the inventions have been in the opposite direction, tending to give us more ease and rest, as, for example, the telephone, elevated railroad, and the electric light. If the latter is perfected, it may also enable us to breathe a purer air. An improved system of education, with less 'cramming,' would tend to reduce the increase of insanity. The eclipse of the mind cannot be predicted like the eclipse of the sun, but, with study, men may learn to detect it in its first stages, and, if treated early, it need rarely become serious."

Artificial Diamonds at Last.

Professor Story Maskelyne, who examined Mr. Jame MacTear's presumed "diamonds," an account of which was published on page 88, present volume, has written the following letter to the London *Times* on those produced by Mr. Hannay:

"SIR: A few weeks since I had to proclaim the failure of one attempt to produce the diamond in a chemical laboratory. To-day I ask a little space in one of your columns in order to announce the entire success of such an attempt by another Glasgow gentleman.

"That gentleman is Mr. J. Ballantine Hannay, of Woodbourne, Helensburg, and Sword Street, Glasgow, a Fellow of the Chemical Society of London, who has to-day sent me some small crystallized particles presenting exactly the appearance of fragments of a broken diamond.

"In luster, in a certain lamellar structure on the surfaces of cleavage, in refractive power, they accorded so closely with that mineral that it seemed hardly rash to proclaim them even at first sight to be diamond. And they satisfy the characteristic tests of that substance. Like the diamond, they are nearly inert in polarized light, and their hardness is such that they easily scored deep grooves in a polished surface of sapphire, which the diamond alone can do. I was able to measure the angle between the cleavage faces of one of them, notwithstanding that the image from one face was too incomplete for a very accurate result. But the mean of the angles so measured on the goniometer was 70° 29', the correct angle on a crystal of the diamond being 70° 31·7'. Finally, one of the particles, ignited on a foil of platinum, glowed and gradually disappeared exactly as mineral diamond would do.

"There is no doubt whatever that Mr. Hannay has succeeded in solving this problem, and removing from the science of chemistry an opprobrium so long adhering to it; for, whereas the larger part of the great volume recording the triumphs of that science is occupied by the chemistry of carbon, this element has never been crystallized by man till Mr. Hannay achieved the triumph which I have the pleasure of recording to-day. His process for effecting this transmutation, hardly less momentous to the arts than to the possessors of a wealth of jewelry, is on the eve of being announced to the Royal Society.

"I am, Sir, your obedient servant,

"N. STORY MASKELYNE.

"Mineral Department, British Museum, Feb. 19."

Nashville's Centennial.

The hundredth anniversary of the settlement of the city of Nashville, Tenn., will be celebrated by the holding of an exhibition of the arts and sciences, beginning April 23 next and continuing until May 29.

The Citizens' Centennial Commission announce that active preparations are making for a first-rate exhibition, and that a wide-spread interest in the undertaking is already aroused, giving promise of a display which shall excel anything Nashville has seen before. The Exhibition buildings are in the heart of the city, easy of access, and amply provided with facilities for the display of manufactures, machinery in motion, inventions, works of arts, and natural products.

The reception of exhibits will begin April 5 and close April 22. Exhibitors of running machinery are requested to have their exhibits in place by April 17. Applications for space should be made to Mr. B. J. McCarthy, chairman of the committee on assignment, space, etc., and for general information to Dr. G. S. Blackie, corresponding secretary, Nashville, Tenn.

Manufacturers of articles finding or seeking a market in the South will find this a good opportunity for placing their wares before a large and thrifty portion of the Southern public. Nashville is not only an important railway center, but is in the heart of a region rapidly increasing in commercial and manufacturing importance. No premiums are offered, and there is no charge for space.

An International Leather Show.

An International Exhibition of leather and leather goods, furs and pelts, tanner's materials, shoe and leather machinery, and the like, is contemplated from May to November, 1881, at Frankfort-on-the-Main. The circular of the provisional committee states, that this exhibition is intended to bring together from all parts of the world all the different raw materials, and to show in successive stages the manner and means of their being manufactured and adapted to the wants of man. It will show how art and science and labor and capital have been constantly and quietly working for the advancement of civilization in this industry, fully as much as in any other.

Frankfort-on-the-Main has been selected as the central city of Germany, and a committee composed of prominent men in the principal industries, with men of science and art, will do all they can to make it a most complete and successful exhibition.

Steam Dredges Wanted for Erie Canal.

State Engineer, Horatio Seymour, Jr., reports the serious filling up of the State canals and the great need of steam dredges for the removal of the accumulating mud.

Many streams empty into the canals, carrying in time of freshets a large amount of mud and gravel. Every city and village along the line pours in more or less sewage. Offal is thrown out from boats, and through every city and village ashes and every other rubbish are thrown into the canal. This material which accumulates during the year, as a rule, must be within a few days removed in the spring. Every year a portion of this deposit is taken out, but the time is so limited, and the difficulty of handling it is so great, that there is not as much removed as comes in.

The consequence is that the canal has gradually been filling up. In order to allow boats to draw 6 feet of water, the levels of the canals have been raised, making it necessary to lift up the bridges to allow boats to pass under. The Erie survey of 1876 showed that the bottom of the canal had been worn away in the center under the boats to more than 7 feet in depth, but at the sides deposits existed varying from 6 inches to 2 feet high, and extending over one half of the bottom. The amount of this deposit was estimated to be about 900,000 cubic yards. This has increased since that time to about 1,000,000 cubic yards. Last spring a great effort was made on all the divisions to clean out the prism, but the time was so short (18 days) that not more than 100,000 yards were removed. Although but a small part of the whole deposit was removed, this work had a marked effect upon navigation, as the boatmen will testify. The whole of this material can be taken out by dredges, in the summer, without interfering with navigation, in four years, at a cost of about 12 cents a cubic yard, which will give to the canal a uniform depth of 8 feet. Experience shows that it cannot be well removed by hand, except at very great cost. Last spring, $30,000 was spent on the Western Division for removing deposits. This sum would have purchased a dredge and paid the expenses of working it two years. The Champlain Canal is in an especially bad condition.

Household Water Motor.

In Zurich, Switzerland, the use of a portable water power, so to speak, is being extensively used for household purposes. Firewood, for example, is to be sawn into convenient lengths for burning. A small sawing machine on wheels is drawn by two men to the front of a house. They connect by a flexible tube with the nearest hydrant; the water flows to the machine; the saw dances, and cuts up the wood with surprising rapidity. A portable turbine has also been invented, and employed in many places in the same city, in driving a Gramme machine for the production of electric light. Water is very abundant in Zurich; but there are other towns in which this domestic water power could be advantageously introduced. Where it is any object to keep a record of the water used an indicator showing the quantity might be affixed to the machine.

The Best Fire Apparatus.

Norwich, Conn., is supplied with water from an artificial pond three and a half miles from the city. It is brought to the city in pipes by gravity pressure. The city is provided with two way hydrants located not more than 600 feet apart. A water pressure is obtained at the hydrants equal to 85 lb. to the square inch, which will throw an effective fire stream over any building in the place. Chief Carrier relies entirely upon the hydrant pressure. He uses four-wheel hose carriages, 600 feet of hose on each reel, and twenty men to each company. He has four steamers, but they only respond to second alarms, and have not been called out in a year and a half. The department controls all fires by means of the hydrant streams. This is the cheapest and best fire service to be obtained—fire streams direct from hydrants. Cities putting in waterworks should keep this point in view.

Onions.

From our own experience, and the observation of others, we can fully indorse the testimony of the St. Louis *Miller*, on the healthful properties of the above esculent. Lung and liver complaints are certainly benefited, often cured, by a free consumption of onions; either cooked or raw. Colds yield to them like magic. Don't be afraid of them. Taken at night all offense will be wanting by morning, and the good effects will amply compensate for the trifling annoyance. Taken regularly they greatly promote the health of the lungs and the digestive organs. An extract made by boiling down the juice of onions to a sirup, and taken as a medicine, answers the purpose very well, but fried, roasted, or boiled, onions are better. Onions are a very cheap medicine, within everybody's reach, and they are not by any means as "bad to take" as the costly nostrums a neglect of their use may necessitate.

M. THOLLON has recently observed, by the aid of his spectroscope of high dispersive power, a solar protuberance whose height equaled one-sixteenth of the diameter of the sun, or about 55,000 miles.

NEW PLASTERING MACHINE.

The annexed engraving represents a novel and simple tool which is intended to replace the hawk and trowel ordinarily used for plastering walls, and to facilitate the operation, so that a greater amount of work can be done in a given time than with the ordinary tools.

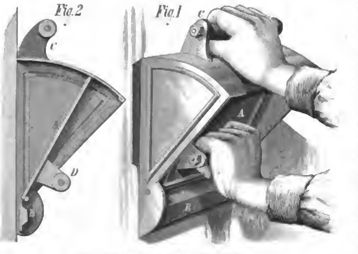
The mortar receptacle is made in the form of a segment of a cylinder, and has a movable leaf or presser plate, A, pivoted near the gauge bar, B. The tool is grasped by the handle, C, attached to the convex end, and by the handle, D, projecting from the movable plate, A. The edges of the mortar receptacle are rounded at the ends to form runners which guide the tool smoothly over the wall. The gauge bar, B, is made adjustable to regulate the thickness of the coating applied to the wall.

When the presser plate, A, rests against the ledge at the rear edge of the curved end of the tool, the receptacle may be filled with mortar. The machine is then applied to the wall with the gauge bar downward, and, as it is moved upward, pressure is applied to the plate, A, through the handle, D, when the mortar will be forced out of the narrow opening at the bottom.

The inventor informs us that a workman using one of these machines can perform the work of two men using the ordinary tools, and the work will be done with greater uniformity.

Fig. 1, in the engraving, shows the manner of using the tool, while Fig. 2—a transverse section—shows the arrangement of the presser plate, A, and gauge bar, B.

This useful tool was recently patented by Messrs. G. Stevens and E. F. Guild. Any further information may be obtained by addressing Mr. Egbert F. Guild, East Saginaw, Michigan.



GUILD'S PLASTERING MACHINE.

IMPROVED STONE POLISHING MACHINE.

Our engraving represents an improved machine for polishing all kinds of stone, but more especially adapted for polishing different varieties of granite and heavy blocks of marble. It is new in design, and combines many valuable improvements which render it very efficient. Beside a vertical movement of the entire machine, which adapts it to stone blocks of different heights, the polishing disk may be moved up or down within certain limits, to increase or diminish the pressure on the face of the stone or to stop the action of the polishing disk altogether, if necessary. The polishing disk is connected with its spindle by a universal joint, so that it may adapt itself to slight inequalities in the surface of the stone or to a variation of the face of the stone from a true level.

The spindle of the polishing disk is provided with cone pulleys, corresponding to the cone pulleys on the countershaft in the joint of the arms, so that the speed of the spindle may be varied to suit polishers of different sizes, and to adapt it to both roughing and finishing.

The journals are provided with heater boxes which do away with a great amount of friction. The polisher works on a half circle of twelve feet and will polish work ten feet long. The work may be arranged so that, while polishing one stone, another can be placed in position. The machine is supported by a single vertical post; and may be very easily set up. It is made wholly of iron and steel, and is well calculated for the work it is intended to perform.

Further information may be obtained by addressing the patentees and manufacturers, Messrs. M. Wright & Son, Montpelier, Vt.

The Buffalo Pipe Line.

The Buffalo Pipe Line Company have secured a right of way from the Bradford District to Buffalo, N. Y., and expect to have the line in operation by June. The main line will be about 65 miles in length, the pipe 4 inches in the clear, and requiring about 7,000 barrels of oil to fill it. The line will begin at a point near the State line, in the town of Allegany, Cattaraugus county, and its route will be through the towns of Allegany, Humphrey, Franklinville, Ellicottville, and Ashford, in Cattaraugus county, and Springville, Concord, Boston, East Hamburg, and West Seneca, in Erie county, to Buffalo. There will be two pumping stations, one at the starting point, and the other midway between there and Buffalo. Tankage will be provided at the latter place for the storing of about 1,000,000 barrels crude oil.

Our Lakes.

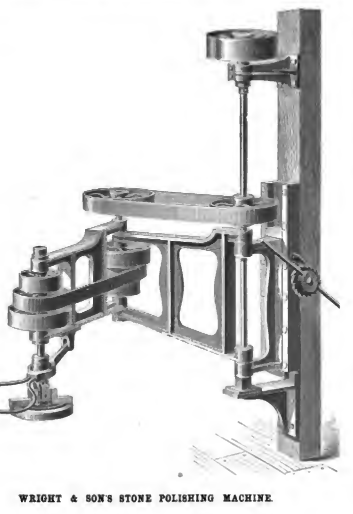
The latest measurements of American fresh water seas are thus given: The greatest length of Lake Superior is 335 miles; its greatest breadth, 160 miles; mean depth, 688 feet; elevation, 627 feet; area, 82,000 square miles. The greatest length of Lake Michigan is 300 miles; its greatest breadth, 108 miles; mean depth, 690 feet; elevation, 506 feet; area, 20,000 square miles. The greatest length of Lake Huron is 200 miles; its greatest breadth, 169 miles; mean depth, 600 feet; elevation, 274 feet; area, 20,000 square miles. The greatest length of Lake Erie is 250 miles; its greatest breadth is 80 miles; its mean depth is 84 feet; elevation, 555 feet; area, 6,000 square miles. The greatest length of Lake Ontario is 180 miles; its greatest breadth, 65 miles; its mean depth is 500 feet; elevation, 261 feet; area, 6,000 square miles. The length of all five is 1,265 miles, covering an area upward of 135,000 square miles.

The Magnet in Milling.

Magnets and magnetic separators are a comparatively new thing in milling; but perhaps there is no contrivance employed in our mills, whose utility is so unquestioned, or which has grown into such wide use in so short a time, as the magnet in the forms of gangs and separators. Since they have become a necessity in our mills, many a time when looking over the assortment of iron taken from his wheat, has the miller wondered why people never thought of using magnets before as a means of cleaning wheat. Millers will remember the commotion which the introduction of the wire binder caused. And there was good reason for the opposition which millers manifested to the use of the wire binder by farmers. Many, who at first sight saw nothing objectionable in wire-bound wheat, were soon loudest in their clamors against it. They had relied upon cleaning machinery of unquestioned excellence to remove what bits of wire should chance to find their way into the wheat; but time soon showed that the crooked little pieces of wire would work their way through the best cleaning machinery, thence go to the burrs, where they were flattened out into saws, and then to the bolts, where they played havoc with the cloth. In some sections, where the wire binder was exclusively used, bits of wire could be traced even into the bread, and be found in an incomprehensible abundance in all mill products. It got into the bran and choked cattle fed on it. It blackened the burrs and destroyed the bolting cloth. In fact, wire in wheat became an unbearable nuisance in spite of every precaution against it—and then came the magnet.

Never did so simple a remedy cure such wide-spread disaffection. Millers' associations had tabooed the wire binder and passed resolutions favoring a discrimination in price against wire-bound wheat. This journal had declaimed against it until it felt hoarse; but the magnet removed every objection to the wire binder by taking out the insidious bits of wire. Every miller who tried the remedy was satisfied, and the clamor ceased. The truth is, that the introduction of magnets as a grain-cleaning agency opened the eyes of millers to a few facts of which they had been ignorant before. They had been perfectly cognizant of the damage done by wire in wheat, but no one expected such a revelation as the use of magnetic separators gave us all. Most of us knew that the magnets would show that wire existed where its presence was never suspected, but who would have looked for such a collection of metallic odds and ends as these separators bring to light? In the course of a day a large merchant mill will take from its wheat, by means of magnets, a miniature junk shop. You will find everything represented, from tenpenny nails down to bits of iron as small as a pin head. How all of it got into the wheat is a mystery; but one thing is certain, that much of this iron must formerly have gone to the burrs and bolts; and, if the wire binder had never been invented, magnetic separators would find a useful place in every mill. But the wire binder has come to stay. Revolutions do not go backward; and it is not at all likely that the farmer will ever again rely upon "tramp" labor in harvest after once having had his wheat gathered by one of these binders. Therefore we must expect wire in our wheat along with nail heads and other rural products. So far, the magnet is the only effective means discovered, by which the miller can remove wire from his wheat; and, therefore, the magnet and magnetic separators are probably as much of a permanency in milling as the wire binder is in agriculture.—*American Miller.*

INTELLIGENT WORK PAYS: Eight years ago Wisconsin's butter and cheese product was worth \$600,000; in 1879, it was worth \$2,500,000, and during this time the State has advanced from no standing to the first rank in the markets of the world. This profitable progress is justly attributed, by the *Jefferson County Union*, very largely to the educational influence and fostering care of the State Dairymen's Association, and promoting exhibits at the Centennial in Philadelphia, and at the two International Dairy Fairs at New York.



WRIGHT & SON'S STONE POLISHING MACHINE.

MISCELLANEOUS INVENTIONS.

Mr. John Hill, of Columbus, Ga., has recently patented an improvement in the class of fire extinguishers employed in large buildings, in which a stand pipe is connected by branch pipes and valves with a set of sprinkling pipes in each story, whereby the water may be showered down in any room or compartment in which a fire may take place. The invention consists, mainly, in connecting the valves of each branch pipe where they join the stand pipe and lead to the several stories with a common station by means of shafts and toothed gears, and providing a handle or hand wheel on each floor with the valve, whereby the turning on of the water from the stand pipe to the branch pipe of any one story may be effected either upon that floor or from a common station below.

Mr. William Brown, of Greenpoint, N. Y., has patented an improvement in the class of barrel lifters consisting of a hoop and two clamps, the latter being pivoted to opposite sides of the hoop and provided with handles. This useful invention was fully illustrated and described in our columns not long since.

Mr. Upton Miller, of Mount Morris, Ill., has patented an improved washing machine. This invention relates to that class of washing machines in which the clothes are compressed between reciprocating pressing boards.

Mr. Christopher G. Dodge, Jr., of New York city, has patented an improved calcimine, or distemper paint consisting of Paris white, glue, white soap, chloride of calcium, carbolic acid, and water, mixed in certain definite proportions.

An improved gag-runner for harness, which is so constructed that they may be readily adjusted higher and lower, and may be conveniently attached and detached, as required, has been patented by Mr. Marshall R. Dowlin, of North Adams, Mass. The invention consists in the combination of a metal hook with the loop of a gag-runner.

An improved beehive, patented by Mr. Erasmus H. Key, of Mayfield, Ky., is provided with better arrangements or provisions for the health and comfort of the bees and for the convenience of the bee-culturist than those ordinarily in use.

Mr. John R. Roberts, of Youngstown, O., has patented a towel rack formed of a single piece of wire having its end parts bent to form the brackets and the bearing loops for the roller.

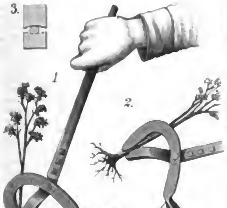
An improved recording apparatus for spirit meters, patented by Mr. John M. Cayce, of Thompson's Station, Tenn., is mainly an improvement upon letters patent of the United States No. 211,554, granted to the same inventor January 21, 1879.

An improved clasp for albums has been patented by Mr. Sidney Posen, of Offenbach-on-the Main, Germany. The object of this invention is to furnish an improved clasp for albums or other books that may be opened and closed and so held automatically.

Mr. Charles Y. Beach, of Fairfield, Conn., has patented a composition for the manufacture of rubber or other gum cloth or fabrics, consisting of caoutchouc or other gum and cotton or other fiber, prepared by grinding together.

IMPROVED SPROUT PULLER.

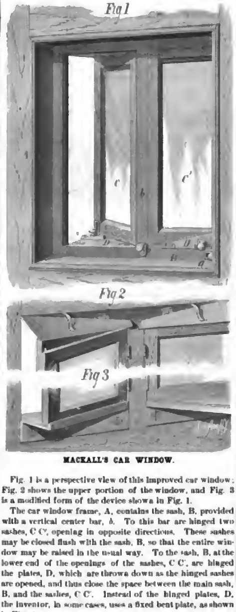
Sprout or grub pullers, as commonly made, have sharp jaws, which are liable to cut or break the sprout, and they are otherwise inefficient and inconvenient. The annexed engraving represents an improved puller patented by Mr. James W. Snapp, of Jasper, Tenn., and designed to avoid the imperfections of its predecessors. It has two rounded jaws, which are concaved laterally on their grasping surfaces to prevent cutting or breaking the sprout. One of the jaws is curved and attached to a fulcrum block having a rounded bearing surface, which is large enough to furnish a steady support. The manner of using the tool is clearly represented in the engraving.



SNAPP'S SPROUT PULLER.

IMPROVED CAR WINDOW.

The car window shown in the engraving is especially designed for sleeping and drawing-room cars, but it is equally well adapted to ordinary passenger cars. It makes an effective ventilator, and at the same time prevents the entrance of smoke, dust, cinders, and rain without in any way obstructing the view.



MACKALL'S CAR WINDOW.

Fig. 1 is a perspective view of this improved car window; Fig. 2 shows the upper portion of the window, and Fig. 3 is a modified form of the device shown in Fig. 1.

The car window frame, A, contains the sash, B, provided with a vertical center bar, *b*. To this bar are hinged two sashes, C C', opening in opposite directions. These sashes may be closed flush with the sash, B, so that the entire window may be raised in the usual way. To the sash, B, at the lower end of the openings of the sashes, C C', are hinged the plates, D, which are thrown down as the hinged sashes are opened, and thus close the space between the main sash, B, and the sashes, C C'. Instead of the hinged plates, D, the inventor, in some cases, uses a fixed bent plate, as shown in Fig. 3.

The tops of the sashes, C C', are covered by triangular water shed plates which are hinged to the sash, B, and open outwardly when the hinged sashes are opened. They are pressed against the sashes by springs secured to the sash, B.

These water shed plates may be constructed like Fig. 3, and are then stationary and fastened to the car window frame.

In going in a given direction only the hinged sashes furthest from the front end of the car are opened. By means of this arrangement the foul air is exhausted from the car as it proceeds, without the entrance of dust or cinders.

Further information may be obtained from Mr. Douglass Green, Columbus, Ga.

Fire-proofing Cotton Fabrics.

In a paper on some conditions of inflammability, read before a sanitary convention in Michigan, Dr. Kedzie, of the State Board of Health, said that cotton clothing could be prevented from taking fire by the use of borax in starching—a teaspoonful to each pint of starch after the water has been added. The borax can have no injurious effect upon the cloth or upon the wearer, and is so cheap that all can afford to use it.

Dr. Kedzie showed by experiments that muslins and tarletans, the most inflammable goods, when treated with borax starch, could not be made to burn with a blaze. If all cotton dresses and underclothing, and especially the clothing of children, were treated in this way, a great number of lives and much suffering would be saved every year.

Dr. Kedzie said he expected that one of these days some shrewd fellow would use this receipt, mix starch and borax, and sell it as "asbestos starch," or with some other catching name, at 500 or 600 per cent profit, and get rich out of it. The people could just as well do their own mixing and save the profit.

Cotton Factories in the South.

Mr. Francis Fontaine, Commissioner of Land and Immigration for the State of Georgia, asserts that no cotton mills in the world have been so profitable as those of Georgia during the past decade. The Chattahoochee River, at Columbus, furnishes one of the best water powers in the world; and at this point are 60,000 spindles in operation. One company at Columbus has a mill employing 1,800 operatives, all natives except the foremen, and manufacture over one hundred varieties of goods. They use 13,000 bales of cotton per annum and 800 lb. of washed wool daily, and pay out $600,000 per annum.

The total number of spindles in the Southern States—687,200—are distributed as follows:

States.	Spindles.
Arkansas	1,700
Alabama	68,000
Georgia	197,000
Kentucky	11,364
Louisiana	6,200
Mississippi	70,000
Maryland	113,000
Missouri	26,000
North Carolina	96,300
South Carolina	92,100
Texas	9,300
Tennessee	49,540
Virginia	53,000

The Climax of Invention.

The Bridgeport *News* very cleverly describes an invention, credited to a Bridgeport Yankee, to prevent marketmen from palming off old eggs for fresh ones. The inventor proposes to arrange a rubber stamp in the nest of every hen, with a movable date. This stamp is arranged with a pad that is saturated in indelible ink. When the hen lays an egg, as is well known, she kicks slightly with her hind leg. An electric disk is arranged so that her foot touches it, and the stamp turns over on the ink pad, and then revolves, stamping the date on the egg. The hen then goes off about her business, the farmer's hired girl removes the egg, and replaces the stamp, which is then ready for another. On each evening, after the hens have retired to their downy roost, with the roosters, the date of the stamp is altered for the next day, and the work goes on. In this way there can be no cheating. You may go to the grocery and ask for fresh eggs, and the grocery man tells you he has some eggs of the vintage of January 29, 1880, for instance. You look at them, and there are the figures, which cannot lie.

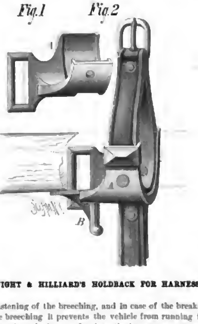
Flooring for Brooklyn Bridge.

The contract for the under flooring of Brooklyn Bridge has been awarded to the proprietor of the Hayford process for the preservation of wood. There will be required about 1,100,000 feet of yellow pine, which will first be thoroughly dried and then charged with creosote under pressure.

NEW HOLDBACK FOR HARNESS.

The accompanying engraving represents an improved holdback lately patented by Messrs. J. Knight and H. Hilliard, of Musquash Parish, New Brunswick, Canada. It consists of a curved metal plate or shell, A, having inwardly projecting flanges forming a seat for the thill strap and having an eye for receiving the holdback strap. The shell has a mortise for the thill strap to pass through, and the rear edge of the shell has a notch for receiving the hook, B, attached to the thill.

This device takes the wear and pressure of the thill and thill hook, and relieves the strain on the girths. It insures the fastening of the breeching, and in case of the breakage of the breeching it prevents the vehicle from running forward against the horse. It gives the horse greater control of the load than the ordinary holdback, and greatly facilitates harnessing and unharnessing the horse. These and many other advantages will be apparent to those familiar with the requirements.



KNIGHT & HILLIARD'S HOLDBACK FOR HARNESS.

Further information will be furnished by the patentees, whose address is given above.

AMERICAN INDUSTRIES.—No. 36.

THE MANUFACTURE OF POWER PRINTING PRESSES.—A PRINTING PRESS MANUFACTORY—COTTRELL & BABCOCK.

Probably no single feature of our Centennial Exposition, in 1876, occasioned greater surprise to foreign visitors, as well as many of our own people, than the department in which were exhibited copies of over 8,000 different American newspapers. It was a collection which showed, in a way that mere figures could never bring home to the mind, how emphatically we are a reading people. In the first page illustrations of this issue we have sketched the making of the machinery with which many of these newspapers are printed, in a factory, where, also, are constructed machines for the finest letter-press work; in fact, the printing done on these presses includes every variety of what printers know as good work, either in colors or plain black, and from them have been issued some of the most beautiful specimens of the typographic art. The business is one in which American mechanics and artisans have long occupied a leading position, and the establishment we here represent has attained a deservedly high place therein.

It is not our purpose to show by what successive steps, and from what rude original contrivances, the printing press has been brought to its present state of efficiency. Volumes might be written upon this subject. Nor will the mammoth "lightning" presses required by our leading daily newspaper establishments be here considered. Each advance that has been made in the construction of such printing machinery, where fine workmanship was not so much an object as a high rate of speed, has been heralded in the columns of every newspaper in the land. But these large presses, marvels of skill and ingenuity as they are, form only a very small proportion of the number of printing machines which are operated in every city and every large town in the land. For all books, for every description of work in which engravings are used, for printing in colors, and for miscellaneous service, as well as for a great majority of the newspapers of the country, presses are required which, while doing many times as much as could be accomplished by the old hand process, will do a far better class of work than can be obtained where speed is the principal object sought. The SCIENTIFIC AMERICAN, for instance, could not be printed on what are known as the "lightning" presses without utterly destroying its clear and beautiful impression and ruining the work of the artists and engravers who make its illustrations, for the proper presentation of a fine wood engraving not only requires a great deal of time in "making ready," so that each detail of the picture may receive just the right shading and emphasis, but the printing must be done on machines of the greatest exactness, in which each part can be kept to its work with the utmost precision.

In nearly all of this class of printing the types or electrotype plates are secured on a flat bed, which is made to move forward and back under a revolving cylinder, which carries the paper and gives the impression, and with which are connected the rollers for inking. The Adams press, which for many years held the leading position as a machine for book work, differs radically from this plan, and gives the impression with a flat platen, as in a hand press, instead of by a cylinder, the press being very heavy, and working at a comparatively slow rate of speed. Excellent printing can be done on the Adams machine, but it is now fast being superseded by the cylinder presses, and very few new Adams presses are at present being made. It will be readily seen that in running a heavy iron bed plate, of sufficient size to hold the type or the plates of a large newspaper or book form, backward and forward over a track eight to twelve feet long, to make it run even and true to a hair, without any jar, in perfect connection with the large revolving cylinder above it, and so that the heavy impression shall be given each time with entire accuracy and evenness over the whole surface, and to do this work as rapidly as required, with perfect facilities for the even distribution and supply of ink, and the delivery of the printed sheets free from smut or blemish, not only calls for the best of mechanical workmanship, but involves a multitude of details which afford a wide field for the display of practical ingenuity. These are the main points in the working of nearly all power printing presses, but it is only within a few years that they have been so improved as to do their work as well as at present, with so great speed and so little trouble in arranging for each successive form.

For the attainment of these ends, the invention by Mr. Cottrell of his device for controlling the momentum of the cylinder was of great practical utility. Previous to its introduction, the impression cylinder, always turning one way, would at times drive the bed with which it is geared, and again be driven by it, its reversed motion at each end of the track making its speed uneven, and thus destroying that exact working which is a prime necessity for the impression cylinder. To remedy this evil Mr. Cottrell introduced an automatic device for checking the momentum of the cylinder as the bed is retarded, thus keeping the gears up to the work side of the teeth, and harmonizing the motion of the cylinder with the irregular speed of the bed. With this patented friction motion improvement a higher rate of speed is attainable, and a more perfect "register," as printers style the printing of the matter each time exactly where it is meant to go on the paper, and generally making the reading on one page exactly in a true line with that printed on its back.

Of yet greater importance, however, to the smooth working of the press, without jar or an excessive amount of wear and tear, was Mr. Cottrell's patent air spring for stopping and reversing the bed. This has been heretofore described, with illustrations, in the SCIENTIFIC AMERICAN, at the time the patent therefor was issued, and its practical success on presses to which it has since been fitted has fully justified all the estimates as to its value which its inventor then put upon it. All the other movements in a press, except that of the bed, are rotary, but for high rates of speed powerful springs are necessary at each end of the track on which the bed travels, to check and reverse its motion. Mr. Cottrell has made perfect air springs for this purpose, so that a plunger, with an ingeniously fitted and adjustable packing, shall work into an air cylinder; the latter is provided with an automatically working vent at its head, which destroys the vacuum at such point on the return motion as will prevent any suction on the withdrawal of the plunger, and, the exact amount of momentum it will require to compress a given amount of air to a certain density being easily demonstrable, it is thus a simple matter to adjust the air spring as may be required for a light or heavy form on the bed, or for a greater or less rate of speed. The weight of the bed, however, is so much greater proportionately than that of any type form, that a scale showing pressures to which the gauges for the air spring should be set for different rates of speed has been made, and is now fixed on a plate on each machine.

For instance, the plate on a four roller, two revolution press, with a bed 35 by 52 inches, reads:

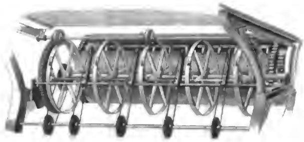


Fig. 1.—COTTRELL'S PATENT SHEET DELIVERY AS APPLIED TO THE COTTRELL & BABCOCK POWER PRESSES.

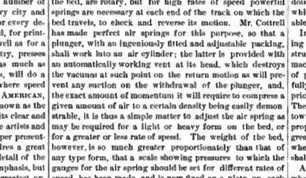


Fig. 2.—COTTRELL'S PATENT HINGED ROLLER FRAME, AS APPLIED TO THE COTTRELL & BABCOCK POWER PRESSES.

Set plungers so gauges shall indicate—

For	800	impressions	an	hour,	15	lb.	square	inch.
"	1,000	"	"	"	20	"	"	"
"	1,200	"	"	"	30	"	"	"
"	1,400	"	"	"	40	"	"	"
"	1,600	"	"	"	45	"	"	"
"	1,800	"	"	"	50	"	"	"

From 2,500 to 3,000 lb. resistance is necessary to overcome the momentum of the bed of such a press, working at a speed of 1,600 impressions per hour, and in no other way it is believed has it been found possible to so adjust the resisting force to the needs of the work so advantageously as is effected in this device. In connection with this air spring, also, Mr. Cottrell has obtained another patent for a "governor attachment," whereby, when the press is started, the spring is automatically put on as the speed progresses, or taken off when it is diminished, or when stopped the bed will come gently to rest. To any printer who has been accustomed to the working of presses with the old style springs, the ease and readiness with which the motion of the bed is controlled, with the aid of these two inventions, no matter what the rate of speed, or how variable it is, seems at first quite marvelous.

Another valuable invention of Mr. Cottrell was his patented device for an improved sheet delivery, as shown in Fig. 1. Previously the delivery of sheets, after the impression had been taken, was effected by a complicated arrangement of wheels and tapes, which had to be readjusted for each new form, and any carelessness in which was likely to cause the ruin of the edges of the types or engravings of the form. By this device the tapes are dispensed with, much time is saved in "making ready," and the sheets are delivered free from smut.

The "Hinged Roller Frame," which is also a patented device of Mr. Cottrell, is shown in Fig. 2, A representing the frame for the distributing rollers, as turned back for convenience in handling or adjusting the form rollers, B. When the press is working these distributing rollers are turned down upon and revolve and vibrate in connection with the form rollers, but they may be swung clear by a single movement, and removed without unscrewing the boxes, or will be again locked in place by the downward movement of the frame. The invention covers one of those important details in which pressmen often lose a good deal of time, which by this device may be saved.

In the engravings on our first page the picture at the top represents the department in Cottrell & Babcock's factory where the large or "drum" cylinder presses are put together, and where much of the detail in finishing the several parts as they come from the foundry is attended to. These presses with large cylinders do not work as fast as those with smaller cylinders, but, with the improvements which have been introduced, they are capable of doing a great variety and most excellent quality of work while being run at a speed which was not formerly attainable.

In the view given in the middle of our large engraving at the left hand side is shown the room for the construction of what are known as "country" presses. These machines are designed as far as possible to meet the wants of printing offices in places where the business is not yet fully developed, and where a few hundred dollars in the price of a machine is one of the leading considerations. There is a great demand for such presses, for in every small town throughout the country which has its newspaper, the proprietor, if he have only a hand press, which is what a great many of them use, is looking forward to the time when his own circumstances and the growth of his town shall warrant him in "coming out" with a power press.

At the bottom of our illustration is shown the department where the presses of latest design and most improved construction are made. The "two revolution" press, as its name indicates, has two revolutions of the impression cylinder for each printed sheet. It is solidly built, and can be run at a speed of from 1,500 to 2,000 impressions per hour, at the same time doing first-class work, either on illustrations or in color printing. It runs smoothly on compensating bearings, which allow for wear so as to maintain uniform accuracy, and, with the various patented improvements which Mr. Cottrell has introduced affords a "working" machine of acknowledged desirability in any first-class printing office. The "stop" cylinder press, however, represents the very highest attainment in this class of machines for the production of the higher grades of work. The cylinder makes but one revolution for each impression, stopping for each sheet, while the motion of the bed continues; the latter has four separate bearings directly under the point of impression, giving absolute solidity, and the sheet is so fed on the cylinder, while it is at rest, as to insure a uniformly perfect register. The ink distribution is very thorough, as it must necessarily be in all fine work, and the impression can be adjusted to a hair. The firm call this machine the *ne plus ultra* of printing machines; but, although so much has already been done in the way of improving printing presses, we are not disposed to concede that the end has yet been reached, thoroughly excellent as this press is.

The "perfecting" presses made by the firm, for printing both sides of the paper while the sheet is going through the press, is built with a cylinder for curved stereotype plates for reading matter, over the drum cylinder, around which the paper afterward passes and receives an impression from the form on the flat bed, where the illustrations and more difficult matter are supposed to be made up. This machine is especially designed for the large illustrated weeklies, in many of which our readers will notice how common it is to have two or more pages with pictures and two or more without, all through—this arrangement coming from the fact that all the engravings are, so far as possible, printed on one side of the sheet of paper, after the other side has been printed, sometimes on a less expensive press. The engravings in this paper, it will be observed, appear with the type matter on nearly all of the pages.

In the general view at the right hand in the middle of the

page is a good representation of the various buildings in which these presses are made at Westerly, R. I. The most prominent building at the right in the picture is the main structure, to the left of which is the pattern shop, while in the rear are the foundry, blacksmith shop, engine room, etc. The buildings cover about two acres of ground, and the location is a most admirable one, on the Pancatuc river, about five miles above Stonington, where coal and iron can be brought direct to the firm's docks, and from whence their heavy machines may be shipped, at but a small cost for freight.

Messrs. Cottrell & Babcock have obtained nine different patents and two reissues, all but one of which were for inventions of Mr. Cottrell, who has devoted all his energy and ingenuity toward perfecting power presses.

The business offices of Cottrell & Babcock are at No. 8 Spruce street, New York, and 112 Monroe street, Chicago, Ill.

The Wire Age.

Whenever, in walking or riding through the streets of our great cities and towns, the eye is directed upward, a perfect network of wires is seen stretching from building to building and from chimney to gable. The appearance is as if some huge spider had been at work silently and covered in the compact city, holding it a prisoner in the meshes of its net. The view is bewildering, and it seems impossible that any practical or important use can be made of these iron wires, so numerous as almost to shut out the sunlight. It is but little more than thirty years since only a single one could be seen connecting some important building with another in a distant city, by which telegraphic communication was maintained; and forty years ago not even one was visible anywhere. We live in the *wire age* of the world's history, and a most interesting and wonderful epoch it is. We know that these iron filaments subserve the purpose of nerves of thought and sensation, and over them, or through them, the world's commerce is carried on. In the human organization we know that if any accident or event happens to the extremities, the fleshly nerves transmit instantly the news to the seat of sensation, the brain; and so it is with the iron nerves in the external world, which science has arranged; not an event of importance can transpire in any part of the globe which is not instantly "*wired*" to the great cities, and the news spreads everywhere with the rapidity of thought.

Until within the past four years, the wires were capable only of transmitting signals of a complex nature, but easily understood and interpreted by experts; now, human beings talk with each other over the iron, and it seems to make, as it were, a unit of the great family of man. Words, actual words, produced by the organs of speech, are ever winging their way, with the speed of lightning, over cities, across rivers and mountains and woods, and voices are recognized scores of miles away. The wires needed in cities for transmitting fire and burglar alarms, for police calls, time signals, and other municipal purposes, are many in number; and when to these are added the wires for telegraphic and telephonic purposes, the question of space or room for them becomes an important one. These wires must all be independent of each other; there must be no contact anywhere; else serious errors and complications occur. In this city the fire alarm system has been so often interfered with that the chief engineer has called the attention of the city government to the matter.

The time is not far distant when additional wires will become necessary for the purposes of electric lighting, and, perhaps, warming. In the years to come the whole country will be covered with them unless some plan is devised by which electrical currents can be conveyed in the earth by wires protected in tubes of clay or metal. It is certain that some method of this nature must be adopted, and that quite speedily.—*Boston Journal of Chemistry.*

Working Wire.

There are many jobs which require wire, in some one of its many sizes and in some form, as rings or springs, to complete them. Improperly treated, wire is a very obstinate material, if at all "springy" or possessing temper, either from condensation by drawing, or by hardening, it will not occupy the space or shape in which it is formed, and calculation or experiment is necessary to guide the workman to a satisfactory result. All wire of any stiffness, when coiled, will open or expand, making the coil larger in diameter and longer in stretch. In ignorance or neglect of this quality, a workman once tried to form a spiral spring of wire to play upon a flat rod one inch wide by three-eighths of an inch thick. He wound the wire on the flat rod, and when released the spiral was a sight to make his shop companions laugh. The coil was elegant, but scarcely useful; its short diameter and its long diameter alternated in a beautiful geometric spiral, instead of preserving a straight line. Sometimes it is necessary to make a spiral, or rather a coiled spring, of a certain diameter, to fit a hole, or to fit a rod acting as its core or support. It is impossible to give rules to determine the amount of expansion of the coil in diameter, as the nature of the material is so varying. This variation comes from the stiffness of the wire, the size of the wire, and the material—whether brass, iron, or steel.

In the case of desiring to produce a coiled spring of a certain diameter it is best to try a simple experiment with the specimen of wire to be employed. Wind one or two turns on a rod of the proper size for the core, and then, releasing it, measure the interior of the ring or spiral, and compare with the diameter of the core or rod. Reduce the size of the core or rod to an amount a little more than the difference between the size of the hole in which the spring is to work and the rod on which it was formed. If the wire is of a gauge that when wound on a half-inch rod it will fill loosely a hole three-quarters of an inch in diameter, but when allowed to expand the coil requires a hole seven-eighths of an inch, wind the wire on a rod three-sixteenths of an inch smaller than the half-inch rod. This example may not be definite enough to be made into a rule, but it is given as an illustration. A trial should be made, as before mentioned, by coiling the wire around a core of the estimated diameter, and thus determine the amount of opening or spring of the coil. It may be feasible, in some cases, to anneal the wire before forming it into springs. In this case the wire can be wound to the finish size at once. But with brass or iron wire, the springiness of which depends upon the condensation of the particles by the drawing dies, this plan is not practicable, as hardening and tempering by heat and water will not restore the stiffness of the wire. But with steel wire it is better to use the wire in an annealed form, making the spring just as it is to be in its finished state, and then tempering it, a process which is described further on.

It is a comparatively easy matter to make a close or expanding coiled wire spring in the lathe. The size of the core rod having been determined, all that is necessary is to keep the winding wire close to the previous coil, and this can be done by hand feeding and guiding. The rod on which the spring is wound is placed on the lathe centers, and one end of the wire secured in the dog end, when the lathe may be started on a slow speed, the wire being led to it by hand. This is a handy way also to form rings, the coil being cut apart either with a file or cold chisel.

But in forming open or compressing springs, there must be greater care employed. The stiffest open spring from a certain size of wire is that which has the interstices of the same space as the wire's diameter; so, such a spring—or rather two of them—may be formed by winding two wires at the same time, making a close spring, doubled. When completed, one is unscrewed from the other. A more open spring may be guided by means of a thin piece of iron with a hole large enough to receive the core on which the spring is wound, the hole being in one end of the piece and the other having a handle attached. A small hole should be made through the piece close to the large hole to receive the wire. In operation the guide is slipped on the core spindle up to the dog end, the wire passed through the small hole, and secured by the dog. Then start the lathe, holding the guide close against the rotating core, pulling toward the operator, and the wire, passing through the small hole in the guide from one side, winds against the guide on the other. It is evident that the thickness of the guide will determine the width between the coils. A still better way of forming an open spring is to use an engine lathe with screw cutting feed. With this the grade of the spring may be determined with great accuracy.

Sometimes it is necessary to close the ends of close coiled springs so as to make a central pull by means of hooks or loops. There is machinery to do this with rapidity, but for ordinary jobs hand work is sufficient. The closing is effected by a gradual reduction of the diameter of the coils at the ends of the spring. Unless the wire is very rigid and obstinate, repeated blows with a mallet, a lead hammer, or a copper hammer will do the work satisfactorily. The open end of the spring should be held at an angle on the bench block, and the hammer wielded, striking backward toward the held end of the spring, the spring being turned in the hand in the direction of the coiling. Before the end is closed, a looped piece of wire should be introduced to form a holder for the end of the spring, the projecting end of the looped wire to be formed into a hook or ring.

Large springs of large wire, which from its size and rigidity cannot be managed during winding by the hand, should be made on a contrivance similar in principle, build, and operation to the tire tenders in the blacksmith shop, or the pipe formers in a tin shop. These consists of two rolls to give a forward motion to the material and another to give the curvature. In spring forming the modifications consist in substituting narrow wheels with a V or segmental groove on their peripheries for the two rolls, which receive the wire, and a guide instead of the back roll to produce curvature. The two grooved wheels should be geared together, so as to turn in opposite directions, and the guide should be a curved piece, standing at an angle to the axial rotation of the rolls or wheels. And this guide should be capable of being set up to the rolls or moved back from them, to determine the diameter of the coil, and should also be capable of being inclined from a vertical position, more or less, to make a close or open spring. The guide should have a lip on its working edge to guide the wire. With such a contrivance, coiled springs of steel rod, a quarter of an inch and more in diameter, may be readily formed.

Sometimes a weak spring is required where a flat forged spring would be costly. In this case a piece of stiff wire of hard brass or unannealed iron may do the work when coiled two or three times around a core, the coiled portion forming the spring, leaving ends to be formed into loops or secured by screw, or left to act on the movable attachment it is to actuate, as a pawl. The principle of such a spring is seen in an extreme form in the U, or main spring, of a gun lock. In this spring the two long arms have little to do with its action, the spring or life being wholly in the curve between the two arms. The wire spring has its curve in one or more complete circles.

Coiled springs of steel wire are tempered by heating them in a box, or piece of gas pipe, in which they are packed with bone dust or animal charcoal, precisely as though they were to be heated for case hardening. If a piece of gas pipe is used, which is very handy in such work, one end should be closed by a screw plug or cap, and the open end luted with clay. When sufficiently heated—the box or pipe deep red—remove the spring, or plunge spring and its receptacle together into a bath of animal oil. Do not attempt water hardening or the use of crude petroleum. If common whale oil is not handy, melt lard and use it while it is liquid. The wire will be sufficiently hard to require drawing. This should be done by putting the spring in a shallow pan, with tallow or animal oil, over the forge fire, and agitate the pan and its contents until the oil takes fire. Take the springs out, and when the oil is burned off cool them in water.—*Boston Journal of Commerce.*

Correspondence.

Lighting Mines by Reflectors.

To the Editor of the Scientific American:

The proverb, "Necessity is the mother of invention," is so trite that its quotation calls for an apology, but its truth has been demonstrated recently in so valuable a way in the prosecution of an important and dangerous work here, that, for the benefit of other workers in like professions—mining engineers—who may meet with similar difficulties and dangers, I give you the result of an experiment in the use of sunlight as a means of illuminating underground workings.

An important part of my work during the past two years has been the construction of a deep adit level, to serve also as a base of development of the vein and a main channel of out-carry for ores extracted on higher levels of the mine, and it has been attended with serious difficulty and danger in consequence of the existence of inflammable gases in the rock through which it passes. Three serious explosions have occurred during the past six months, due to its ignition by workmen using open lights, and eleven persons were very badly burned. Workmen at last reached such a condition of fear of consequences that they could not be induced to take such chances of death, to earn a living, as work in the tunnel offered. Safety lamps would not furnish sufficient light. The question, then, was what safe means of illumination could be used. This question was decided, in a measure, in a peculiar way, and was the direct result of necessity, which compelled me to go into the header of the tunnel to look after a party of men that had just been burned by an explosion. I had recourse to a common looking-glass for a reflector of the sunlight. The result was marvelous. The whole tunnel was a flood of bright daylight—sides, roof, and floor, throughout its entire length of 2,500 feet, and all furnished by such a glass as can be bought in your city shops for a dime. Confidence was at once restored in my workmen, and now, while we can command the sun, we can command more labor than the work will employ.

The conditions of the tunnel and the philosophy of the light are these:

The tunnel is perfectly straight, 6½ x 5½ feet inside of timbers; its course south 86° 15' west from the mouth; and is ventilated by a current of air forced in by a Burleigh compressor operated on the outside.

The philosophy of the light—its intensity and perfect diffusion—is thus accounted for: The air driven into the tunnel is saturated with moisture in the process of compression, and upon being released in the header, resolves itself into its natural volume, when the excess of water is liberated in the condition of a mist or fog, very light, of course, and millions of these atoms of water become direct reflectors at as many million angles. To convey an approximate idea of the intensity and brilliancy of the light it will, perhaps, be sufficient for me to say that the smallest type used in your publication is as clear at a point 3,000 feet from the looking glass as in the open sunlight, and every item in your paper can be read at any point in the tunnel as rapidly and with as much ease as if out of doors.

It may be that some unfortunate may derive a benefit from having the use of this light suggested to him. If it will save one individual from being burned, as I have been, or as I have seen a number of my workmen, I shall be fully compensated for the time spent in preparing this communication, and you will be entitled to the thanks of the mining profession everywhere for publication.

The light may be used for many purposes underground, and many times diverted from the first mirror line.

JNO. W. C. MAXWELL.

New Idria, California, February 20, 1880.

A Fatal Italian Disease.

An Italian correspondent of the *Lancet* calls attention to an insidious and frightfully fatal disease called "pellagra," of which no less than 97,000 Italians are said to be dying, at the present time, the number of victims representing 3.62 per 1,000 of the whole population, and in the infected departments, especially in Lombardy and Venice, a higher proportion than ever occurred during the worst cholera epidemic in France. The disease usually runs a slow course, like consumption. Its cause is believed to be the exclusive consumption of maize in a deteriorated condition and the unhealthy state of the hovels in which the rustics live.

THE NEW LECLANCHE BATTERY.

The Leclanché battery is now more generally used for open circuit lines than any other, and its peculiar adaptability to the telephone service has given it an immense field of application. In the battery shown in the annexed engraving the porous cup used in the ordinary Leclanché element is dispensed with, and a pair of compressed prisms, containing all the materials formerly used in the porous cup, are substituted for it. These prisms are placed upon opposite sides of the carbon plate, and are kept in place by rubber bands.

The negative pole consists of a pencil of amalgamated zinc, and the two poles are suspended from the cover in a solution of sal ammoniac and water.

The zinc being indefinitely preserved in the sal ammoniac solution, and the peroxide of manganese being insoluble in the solution, no action can take place when the battery is not in use.

After thorough tests by the various telephone companies, this battery has been universally acknowledged to be better than any other for telephone purposes, as all of its parts are visible, and any derangement may be at once discovered. The battery is readily taken apart, cleaned, and set up again. To do this requires no special knowledge of electrical apparatus. When the elements become exhausted from long service, they may be renewed by taking off the prisms, soaking the carbon below the head in hot water, attaching new prisms, and setting it up with a new zinc and a fresh sal ammoniac solution.

Further information will be furnished by the Leclanché Battery Company, 40 West Eighteenth street, New York.

Fig. 1 Fig. 2

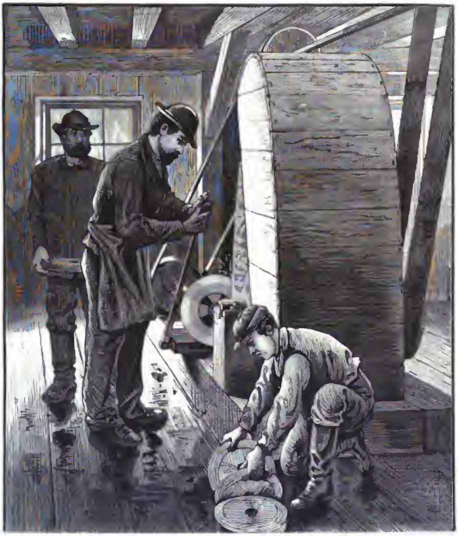
THE LECLANCHE PRISM BATTERY.

STEEL IN AGRICULTURAL TOOLS.

Steel is rapidly taking the place of cast and wrought iron in the manufacture of agricultural implements, and being much stronger than iron, it admits of making the tools not only a great deal lighter, but stronger, and better calculated to resist wear. Our sketch, which we take from one of the departments of the Anderson Steel Works of Pittsburg, Pa., represents one of the processes in the manufacture of rotary colters for plows. The workman has mounted upon the end of a rotating shaft, a disk of tempered steel, which, as it revolves, is pressed forward against the periphery of a huge grindstone revolving in the wooden casing and constantly supplied with water.

The face of the stone is divided into three steps or sections of different diameters, one section being used for roughing the disk, another for shaping it, while the third is reserved for finishing. As the disk is pressed against the stone, the shaft that supports it is oscillated by means of the vertical lever held by its workman. This movement gives the disk its lenticular form.

Messrs. Anderson & Co. make a composite sheet for agricultural tools and other purposes, consisting of an iron central portion faced on both sides with steel. The method of making this article is extremely simple. The mould into which the steel is poured contains a thick plate of iron, which divides it equally and forms the central iron portion of the composite ingot which is afterward rolled into sheets. As the hot steel is poured into the mould it is perfectly welded to the sides of the iron plate.



GRINDING ROTARY COLTERS.

THE opinion of travelers that there is no danger in bathing in the Dead Sea, because one cannot sink in its heavy waters, has met with a rude shock. A lady's maid ventured out beyond her depth, and floated face down. She was turned over and brought ashore with great difficulty, after having swallowed enough of the acrid water to make her dangerously sick.

The Largest Haddock Fare Ever Landed.

The schooner Martha C., Captain Charles Martin, arrived at Boston recently with a fare of 72,000 lb. haddock, the largest amount ever landed on a single trip, which sold at $25 per 1,000 lb., giving her a stock of $1,803. She was absent seven days, and engaged in fishing two days. The expenses of the trip were $137, and the crew of fourteen men shared $76 each. The largest fare before reported was 70,380 lb. taken on Georges, in 1878, by schooner E. L. Rowe, Captain Sewell W. Smith, on a five days' trip. The largest fare ever taken in one day's fishing was 54,200 lb. by schooner Paul Revere, Captain John Bentley, in 1877.—*Cape Ann Advertiser.*

ACID PROOF CEMENT.—Make a concentrated solution of silicate of soda, and form a paste with powdered glass. This simple mixture will sometimes be found invaluable in the operations of the laboratory where a luting is required to resist the action of acid fumes.

Then and Now.

Owing partly to the improvement in tools and shop appliances, and partly to the system of subdivision of labor, there is no parallel by which the workman of to-day can be gauged or compared with the workmen of thirty or forty years ago. Then the apprentice was taught—crudely, perhaps, but still taught—all the mysteries of his calling, from the preparation of the crude material to the finish of the completed result. The carpenter hewed his timber from the tree trunk or limb by means of chalk line and broadax. He bored, and mortised, and cut tenons, erected the frame of the building, boarded and shingled, and clapboarded and lathed. The blacksmith shod horses and oxen, tired wheels, made bolts and nuts, chipped and filed and drilled, forged and tempered axes and chisels, and performed numberless jobs of a variety of forms and for a variety of purposes. The machinist sometimes made his own patterns and often his own tools, worked at the vise and the planer, the lathe and the forge, and was ready to undertake any job, from repairing a broken stove to building an engine.

Our venerable contemporary, the Boston *Journal of Commerce*, remembers when the above practice was universal. We congratulate it on surviving to see all this changed. Now timber is sawed and not hewed; mortises and tenons are machine cut; houses are built by the shinglers, the lathers, and the joiners, as well as by the carpenters; and the doors, windows, window and door frames and sashes are factory built. The horseshoer does nothing else. The forger of steel seldom works iron. The tool maker is nothing but a tool maker. The machinist is a bench man, a lathe man, a planer, a fitter, or he has a specialty in cotton machinery or woolen, or never works but on steam machinery.

It cannot be expected that the man who has worked only in a certain department will be entirely at home in others, but, on the other hand, he who has worked at all branches will not be likely to be an expert in any one branch. In versatility and in contriving makeshifts, he who learned his trade when the arts were young, and performed a portion of all the work, is better than the specialist; he may be an invaluable man in a crisis. But the lather can prepare a room for the plasterer with much greater rapidity and in better shape than the carpenter who turns from making a door to lathing a room. The tool forger can temper steel better than the blacksmith who turns from the forging of a mill crank to the tempering of a turning tool. The machinist who has worked for years on steam engines can sooner put a disabled engine to work than one who learned his trade at building cotton machinery. In the one case, the man is an expert; in the other, simply a workman.

Meteoric Iron in Snow.

Observations of snow collected on mountain tops, and within the Arctic circle, far beyond the influence of factories and smoke, confirm the supposition that minute particles of iron float in the atmosphere, and in time fall to the earth. By some men of science, these floating particles of iron are believed to bear some relation to the phenomena of the aurora. Groneman, of Göttingen, for instance, holds that streams of the particles revolve around the sun, and that, when passing the earth, they are attracted to the poles, thence stretching forth as long filaments into space; but, as they travel with planetary velocity, they become ignited in the earth's atmosphere, and in this way produce the well known luminous appearance characterizing auroral phenomena.

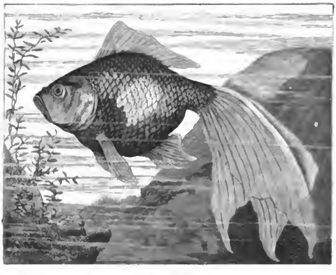
Professor Nordenskjöld, who examined snow in the far north, beyond Spitzbergen, says that he found in it exceedingly minute particles of metallic iron, phosphorus, and cobalt.

THE KINGIO AND THE TONG-TSING-YO.

The kingio, one of the most beautiful varieties of the golden carp probably ever bred, was imported from Japan by Mr. Gill, of Baltimore, a few years ago. After much persuasion and an offer of $500, one of the most beautiful of the few that reached this country alive was secured for the aquarium.

Too much can hardly be said of the wonderful beauty and grace of this fish. Its sides were resplendent with delicate pearly and golden tints, which, as it moved through the water with great dignity, are constantly changed in degrees of color under the various angles of light. It is said that this single specimen yielded to the establishment not less than $3,000 profit. Had it been fed on vegetable food instead of animal (raw liver) it might still be alive. The caudal and anal fins of this fish were united, and were of a pearly white color and of a delicate texture, which, as the kingio passed through the water, floated gracefully behind the fish as if composed of some delicate fabric. Several attempts have been made to establish this variety in this country, but all the specimens I have seen thus far seem to have gone back to the original starting point, which undoubtedly is the golden carp or our common gold fish.

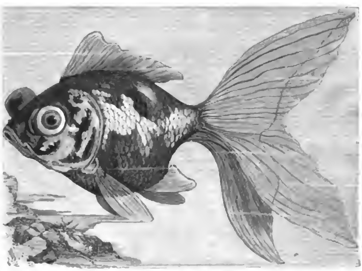
The tong-tsing-yo, or telescopic-eyed fish (also known as the dragon-eyed fish), is a native of China. A few specimens of it were imported to this country a few years ago. This, like the kingio, is undoubtedly another monstrosity of the golden carp, and a very remarkable one, which has been established by continuous selection by the Chinese with the wonderful art they display in breeding these domesticated pets, until the progeny is so disguised that the original form is almost lost. Viewed from the front this fish has a large, broad forehead and great projecting eyes. With this fish the caudal and anal are united, but spread out from the fish, as shown in the illustration.



THE KINGIO.

The Durability of Gutta Percha.

In his lectures before the Society of Arts on the recent advances in telegraphy, Mr. W. H. Preece, the electrician to the British Post Office Department, pointed out some of the curious accidents to which gutta percha covered wires were liable: "Gutta-percha covered wires," he said, "would be very well if they would last. But, unfortunately, gutta percha is a gum that only appears to last when in water. In water it apparently is indestructible. Cables that were laid in 1851, and have been brought up within a recent date, are now as good as the day when first put down. But when gutta percha becomes exposed to the air, to the alternations of climate, especially when exposed to the action of the sun, it decays very rapidly; it oxidizes, and becomes a kind of resin that can easily be crumbled into a snuff-like substance. Many attempts have been made to protect it and to arrest this rapid decay. It has been surrounded by tape soaked with tar. Tar itself has been found to be injurious, and has been supplanted by other materials, but at the present moment we have not yet succeeded in finding anything that renders gutta-percha indestructible. In fact, when exposed to air, as when suspended in tunnels, it seems to have a life of about ten years; when laid down in our iron pipes, under the influence of the variations of temperature and moisture that exist there, it seems to last about twenty years; but in the sea, where it is exposed to equable temperature and equal condition, it apparently seems capable of lasting forever. There are many curious accidents and causes of interruption to working that we meet with in our gutta-percha covered wires, and one of the strangest is one of the last that we have discovered. We have found in many places that this gutta-percha is apparently gradually eaten away. It seems to go not unlike the way in which open air wires rust away; and this curious action only occurs in certain places. In certain parts of the country, North Wales, Dublin, Kent, and in one part and another, we have found this curious action going on; and careful examination and inspection under the microscope have led us unmistakably to conclude that it is due to something or other eating away the gutta percha. Curiously enough, wherever we have detected this action taking place, there, also, we have found swarms of a very minute insect, a very little thing, belonging to what is called the spring tail tribe. It is a little white fellow that you can scarcely see, and when you do see him he seems conscious of the fact, for he immediately disappears with a spring. It is the *Templetonia crystallina*. It abounds in swarms in certain soils, and seems to have a great liking for gutta percha. It does not remain near the wire when it has eaten its way through, but, apparently, immediately retires when it touches the wire, as though it had received a shock, and makes a sudden retreat. It is a curious fact, and until recently it was unknown, that any living creature had a taste for gutta percha."



TONG-TSING-YO.

An Alligator Survives Freezing.

The ability of many of the lower forms of animal life to survive freezing is well known. Even those so high in the scale as fish—cat-fish, for example—may be frozen stiff and kept for days in that state, yet "come to life" when slowly thawed. The first instance of the revival, after freezing, of an animal as high in the scale as an alligator is reported in this city. During a recent cold snap the window of a room, in which was kept a Florida alligator, was left open, and the water in which the reptile lay was frozen. The owner of the animal, a young physician, found his pet "as stiff as a poker," and to all appearances dead. It was placed in warm water, rubbed with alcohol, then wrapped in a cloth and left by a stove to warm up. After an hour or two it was rubbed again and dosed with liquor, its mouth having been pried open. This vigorous treatment was kept up for a couple of hours, when signs of life appeared, and in a few hours more the alligator had entirely recovered.

Foreign Bodies in the Ear.

At a recent meeting of the New York Clinical Society, Dr. G. H. Fox mentioned the case of a patient who for several days had had pain in the ear, with impaired hearing. A wad of soft paper was found firmly impacted in the ear, and was removed. The man had taken a surf bath a few days before, and had first felt the pain and deafness immediately after having been struck on the side of the head by a wave. The only way that he could account for the presence of the paper in his ear was that it had been carried in by the wave.

Dr. A. A. Smith alluded to the case of a lady who had engaged him to attend her in labor, and who complained of headache, dizziness, and nausea, without any evidence of kidney trouble. She soon found that she was somewhat deaf, and Dr. Smith discovered and removed from her ear a wad of cotton half an inch long, which had been inserted five months before. Her symptoms at once disappeared.

Terrapin.

In a letter to the *Republic*, of Washington, "G. H. B." tells what he knows about terrapin. The following facts are of general interest:

It is in Lent that terrapin commands its highest prices. They are worth from $25 to $36 a dozen during the season. A dozen terrapins consist of twelve diamond-backs, no one of which must be less than a "count terrapin," that is, measure seven inches in length on the under shell. The largest known do not exceed ten inches in length and eight pounds in weight, and such prizes are extremely rare. The seven inch terrapin averages four pounds in weight. "Sliders," the common river turtles of almost all the rivers of the South, grow to a much larger size. They bring from $6 to $9 a dozen.

The two or three men who control the trade in Baltimore say that they sell almost exclusively for private tables. Terrapin are caught all the way from Savannah and Charleston to the Patapsco and Gunpowder rivers—scarce here—but the genuine diamond-back belongs almost exclusively to the upper Chesapeake and its tributaries. The majority of the sliders come to Baltimore from the James river and streams adjoining. An active terrapin catcher sometimes makes $50 a week, but the find varies, and often runs down as low as $5. The reptile is discovered by probing the mud in the shallows with a stick. He is dormant and easily captured.

The females are more highly prized, and are known as "cow" terrapin. They generally contain about thirty eggs, some of which you have a right to expect to garnish the dish at $1.25 a plate. I am not betraying confidence in stating that many restaurateurs, reckless of their fair fame, have resort to the eggs of the pigeon made into a paste and rolled into a substitute for the genuine article. Thirty years ago the largest dealer in Baltimore found it difficult to dispose of the terrapin he received at $6 a dozen. The product, he says, is about the same year in and year out. He sells as many now as he did then. The negroes who bring them to market say that they are growing yearly scarcer, and nothing but the high price stimulates them to keep up the supply by a more extended and persistent search. The Commissioners of Fisheries of this State, in their report of 1876, deplore "the much diminished and rapidly diminishing supply of this most excellent luxury of the Chesapeake Bay," and suggest its increase by cultivation. They add: "There are hundreds of localities admirably situated in our terrapin-producing regions which could be made more productive, acre for acre, than the best surrounding land, by the establishment of terrapin ponds."

Importance of Fish Culture.

As the *American Ship* pertinently remarks, Hon. Levi P. Morton has done a good service in calling attention anew to the importance of farming our streams, lakes, and ponds, as well as the sea, that the water as well as the land be made to contribute to the food supply of our constantly increasing population. Norway leads the world in her fisheries, with an annual production valued at $13,600,000, and yet we have opportunities for expanding to a limit even surpassing these enormous figures. The artificial propagation of fish has been attended with encouraging results, first in Germany, then in France, and latterly in the United States, having become one of our most important industries. The United States Fish Commissioners say: "Norway is the only European nation that has a scientific commission occupied officially in the supervision of the fisheries and in devising methods by which they may be carried on and extended with the least possible waste. To the labors and observation of such men as Dr. Boeck, Professor Sars, and others, is due much of the present efficiency of the Norwegian fisheries." In 1867 we imported about as much fish as we exported. If we devoted sufficient energy to the business we could export one hundred times as much, and need import none at all. Fish culture is in its infancy. Its resources are immeasurable. It may approximate and even rival agriculture in importance. Its development will give employment to large numbers of men and bring food within the means of the poor as well as of the rich. The propriety and utility of international exhibitions, like that now in contemplation at Berlin, where the representatives of our nation can learn the nature of the products of the others, as well as show its own in a universal market, can no longer be questioned.

CEMENT FOR REPAIRING GLASS.—Dissolve fine glue in strong acetic acid to form a thin paste.

netically arranged by the friction on the strap, or do they both contribute to the result? A. The edge is produced by abrasion. 2. What kind of a fluid dye will color the wings of a queen bee red or some other bright color (so that she can be readily seen among the bees) without injury to her? It should be something that will not load the wings but leave them light and supple—a dye, not a paint. A. Try an alcoholic solution of the aniline dye magenta.

(28) F. J. will find the wagon wheel question fully discussed on p. 304, Vol. 30 of SCIENTIFIC AMERICAN.

COMMUNICATIONS RECEIVED.

On Drying and Disinfecting Fecal Matter. By A. P.
Mathematical Table. By H. S. P.
How to Make an Electric Burglar Alarm. By O. P. L.
The Use of Lines of the same Height. By K. L.
The Game of 15. By G. C.
On Western Adulterations. By G. T. A.
On the Route for the Panama Canal. By H. S. B.
On Voices of Fishes. By W. H. W.
Sudden Death by Electricity. By H. W. F.
On the Origin of the Atmosphere. By H. M. G.
Who Invented the Telephone? By M. D. T.
Maximum Sun Spot Periods. By E. J. Couch.
On Telephone Experiments. By C. E. L.
Singular Lunar Phenomenon. By H. P.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 24, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Adjustable bracket, C. A. Blessing ... 224,892
Air and gases, obtaining motive power from, T. M. Fell ... 224,772
Alarm lock, W. H. Pearce ... 224,791
Animal carcasses, machine for scraping, S. Collins 224,916
Animal trap, J. A. Hollem ... 224,910
Animal trap, E. T. Lynch et al. ... 224,932
Animal trap, J. S. Simpson ... 224,960
Axle box, G. W. Thomas ... 224,971
Axle cutter, wagon, Harris & Patrick ... 224,894
Axle skein, A. McKellar ... 224,938
Bale tie, G. B. Smith ... 224,900
Baling press, Kamp & Brown ... 224,920
Bed bottom, L. E. Ransom ... 224,946
Bed bottom, spring, W. H. McLain ... 224,935
Bed, cabinet folding, H. Ogborn ... 224,943
Beer cooler, J. Burkhart ... 224,899
Belt elevator, G. E. Perkins ... 224,943
Belt fastener, H. G. & J. T. Redsecker ... 224,951
Blind slat retainer, J. J. Jardine ... 224,918
Blind slats, metallic tenon for, A. L. Hill ... 224,908
Boot and shoe edge plane, L. A. Dunham ... 224,759
Boot leg finishing machine, M. V. B. Ethridge (r) ... 9,098
Bridle bit, J. Stanley ... 224,851
Broiler, reversible, Applegate & Shattuck ... 224,761
Brush wrapper, C. Hollweda ... 224,916
Butter worker and mould, comb'd, H. I. Carver (r) ... 9,093
Button, separable, W. H. Shattuck ... 224,849
Can forming and soldering machine, Bangs & Pierce ... 224,763
Can opener, C. M. Williams ... 224,977
Car brake, electric, P. V. Conover ... 224,900
Car brake, railway, G. B. Stock ... 224,966
Car coupling, Cook & Leas ... 224,901
Car coupling, J. G. Geohon ... 224,904
Car coupling, W. Harkins ... 224,777
Car window, W. C. Hicks ... 224,779
Carding engines and drawing frames, coiling mechanism for, J. Wolstencroft ... 224,979
Carpet stretcher, J. B. Eddy ... 224,907
Carriage, child's, J. E. Wightman ... 224,976
Carriage top, O. C. Coggins ... 224,899
Cartridge shells, manufacture of, T. G. Bennett ... 224,765
Caster, sewing machine, Morsleigh & Bennett ... 224,791
Castings, coating metal, J. Klutz ... 224,925
Chair seat, G. Gardner (r) ... 9,094
Chart for draughting garments, pattern, E. J. Linck ... 224,932
Child's chair and carriage, J. W. Kenna ... 224,923
Chimney cap and cowl, C. C. Caywood ... 224,893
Churn power, T. J. Brittain ... 224,767
Cigarette machine, De Susini-Ruiseco & de Castel-Angeli ... 224,967
Clock, striking, W. D. Chase ... 224,791
Clothes rack, shelf bracket, E. B. Sims ... 224,961
Coffee pot, J. E. Finley ... 224,922
Coin detector, counterfeit, J. A. Thompson ... 224,907
Coin holder, G. C. Hatch ... 224,909
Column, iron, W. J. Fryer, Jr. ... 224,775
Compound engine, J. V. Holloway ... 224,779
Corn sheller separator, R. H. Sheldon, Jr. ... 224,950
Corset parts, machine for folding, A. B. Curtis ... 224,905
Cuff shaping machine, J. K. P. Pine ... 224,794
Cultivator, J. Forbes ... 224,773
Curtain fixture, J. Montgomery ... 224,937
Doffer comb, J. E. Wright ... 224,980
Door check, A. Merlito ... 224,940
Drawing, apparatus for illustrating the rules of perspective, F. O'Ryan ... 224,945
Drying kiln, C. L. Campbell ... 224,914
Dyestuff or coloring matter, F. Kohler ... 224,927, 224,928
Electric brake, dynamo, O. Lugo ... 224,933
Elevator, J. A. Groshon ... 224,909
End gate, wagon, J. S. Howey ... 224,914
Fare collecting apparatus, portable, A. C. Farnsworth ... 224,770
Farm gate, S. G. Hurlbut ... 224,915
Faucet and cap, J. B. Hayden ... 224,914
Feathers, renovating, M. E. Rubin ... 224,947
Fence post, A. B. Hartman ... 224,912
Flour, cooling and drying while reducing grain into, T. H. Hallock ... 224,923
Frame, T. Wallis ... 224,973
Fruit picker, J. C. Merino ... 224,938
Fruit picker, D. C. Williams ... 224,978,
Game apparatus, W. B. Cowan ... 224,902
Gas, apparatus for the manufacture of wood and oil, G. Ramsdell ... 224,845
Gas extinguisher, automatic, T. W. Hamilton ... 224,776
Gas retorts, apparatus for indicating the action of water, H. C. Bowen ... 224,905
Gas retorts, determining the temperature and progress of distillation in, H. C. Bowen ... 224,906
Glass house furnace, J. J. Gill ... 224,906
Grain separator, J. H. Snitt ... 224,901
Grape picker, T. C. White ... 224,975
Hams, apparatus for pickling, W. H. Scudder ... 224,949
Harrow, M. S. Blair ... 224,815
Harvesters, etc., pivoted adjustable seat for, Hedges & Morgan ... 224,788
Hay and cotton press, portable, T. C. Key ... 224,904
Hay press, N. W. Herring ... 224,787
Hay rake and loader, Johnson & Dewey ... 224,783
Hay rake, horse, J. B. Figg ... 224,908
Hoisting machine, L. H. Hall (r) ... 9,096
Holdback, harness, Knight & Hilliard ... 224,928
Horse toe weight, D. & D. Roberge, Jr. ... 224,965
Hydraulic elevator, W. E. Hale ... 224,904
Hydro-carbon burning apparatus, H. H. Eames ... 224,904
Injector for feeding boilers, J. S. Bancroft ... 224,762
Injector for feeding boilers, Sellers & Bancroft ... 224,790
Jacket or envelope for supporting various parts of the human frame stiffened, W. H. Johnstone 224,784
Kettle, skeleton, B. F. Roberts ... 224,957
Key fastener, L. Johnson ... 224,910
Label, C. Rowland ... 224,956
Lamp, car, C. P. Howard ... 224,780
Lantern, Ewing & Hill ... 224,908
Lifting jack, J. Du Shane ... 224,919
Lime and cement kiln, B. F. Holland ... 224,923
Locked switch, J. W. Reinhart ... 224,906
Loom heddle, E. Schopp ... 224,797
Loom shuttle spindle, J. Hamilton (r) ... 9,093
Lounge, extension, C. Street (r) ... 9,100
Marker, land, Kramer & Miller ... 224,929
Match lighting attachment to hats, etc., F. L. Clark 224,879
Mechanical movement, S. Dush ... 224,916
Medical compound, T. J. Robbins ... 224,954
Metal rods or bars, machinery for coiling, P. H. Standish ... 224,963
Middlings purifier, W. L. Teter ... 224,969
Milk can skimmer, G. W. Bolton ... 224,894
Milk purifying and cream raising apparatus, J. W. Powers ... 224,944
Millstone balancing device, L. Read (r) ... 9,091
Millstone driver, Crowell & Talbott ... 224,904
Millstones and tramming spindles, machine for leveling, D. E. Baughey ... 224,822
Millstones, hand tool for dressing, W. L. Teter ... 224,970
Miner's combination tool, W. S. Rosecrans ... 224,957
Mouldings, machine for dressing, J. C. Brandon ... 224,867
Music leaf turner, T. Berry ... 224,901
Music leaf turner, G. H. Nash ... 224,943
Musical instruments, foot guard for lyres of, D. T. Peck ... 224,949
Ore feeder, O'Hara & Felt ... 224,946
Packing, piston, R. Childs ... 224,895
Paint and varnish, compound for removing, W. H. Nordahy ... 224,941
Paper bag, J. McCullough ... 224,934
Peanuts, etc., apparatus for cleaning and scouring, B. F. Walters ... 224,810
Planter check rower, corn, Rollins & Hudson ... 224,796
Planter, corn, F. P. Castanion ... 224,872
Planters, self-dropping attachment for corn, H. C. W. Heers ... 224,906
Plow draught attachment, H. & L. Iwan ... 224,917
Plow, sulky, J., T. P., & J. A. Elam ... 224,901
Pocket, pantaloons, M. Shrier ... 224,959
Pottery ware and mortar, making, J. Fults ... 224,905
Preserving fruit, compound for, J. Craft ... 224,903
Printing machine, E. L. Gilman ... 224,907
Printing on textile fabrics, L. Prang ... 224,949
Protractor and scale, surveyor's comb'd, N. Wilson 224,811
Pump, lift, J. B. Leedy ... 224,931
Pump, rotary, B. Bush ... 224,920
Pumps, valve gear for steam, W. P. Stephenson ... 224,964
Quilting machine, A. Beck (r) ... 9,097
Rails, slitting old, W. Hewitt ... 224,927
Railway rail supporting device, T. W. Travis ... 224,809
Railway switch, street, I. A. Chandler ... 224,874, 224,875
Refrigerating apparatus, W. A. Lighthall ... 224,785
Refrigerator and sideboard, comb'd, E. B. Jewett ... 224,781
Return crate, B. E. Morey ... 224,939
Rolling mill reel, Morgan & Daniels ... 224,899, 224,941
Rolling mills, guide for wire rod, Morgan & Daniels 224,939
Rolling mills, reel for wire rod, C. H. Morgan ... 224,787
Ruler, parallel, C. D. Sigsbee ... 224,962
Sad iron, S. L. Story ... 224,934
Saddle, harness, E. B. Cahoone ... 224,971
Sash fastener, T. M. Foster ... 224,901
Sash fastener, L. K. Lippincott ... 224,930
Saw set, C. Morrill ... 224,790
Sawing machine, drag, Frank & Dickison ... 224,904
Sawing machine, drag, Swinehart & Jourdan ... 224,909
Sawing machine, drag, T. Van Kennel ... 224,809
Scale beam, J. T. Tillman ... 224,972
Scraper, foot, W. J. Fryer, Jr. ... 224,774
Sewing covered nails, machine for, H. Smith ... 224,963
Sewing machines, harness pipe loop attachment for wax thread, D. M. Lewis ... 224,930
Shafting hanger, G. W. Fisher ... 224,921
Sheet metal cans, seaming machine for making, J. W. Farrell ... 224,771
Sheet metal pans, device for forming, M. Kennedy 224,922
Sheet metal pipes, machine for forming circumferential crimps in, W. A. Wheeler ... 224,974
Shoe, engineer's, W. H. Mintzer ... 224,907
Shot, process and machine for making drop, H. J. & W. T. Winterlich ... 224,909
Shoulder and back brace, R. W. Gray ... 224,909
Shuttle spindle, Morrill & Sawyer ... 224,791
Slate, hinged, A. T. Stewart ... 224,965
Snap hook, J. E. Wightman ... 224,936
Sower, hand seed, H. Hill ... 224,909
Spark arrester, J. B. Smitt ... 224,902, 224,903
Speed regulator, H. R. Earnhurst ... 224,764
Sprinkler, E. B. Norton ... 224,944
Stamp, branding, F. Christy ... 224,877
Stamp, revenue, C. Stock ... 224,803
Steam boiler, W. S. Fiske ... 224,909
Steam boiler, W. B. Michener ... 224,936
Steam engine, T. T. Prosser ... 224,959
Stool, piano, M. H. Wilson ... 224,967
Stove leg, Peterson & Beesley ... 224,947
Surgical splints, making, W. H. Johnstone ... 224,781
Tablet, writing, J. F. Tapley ... 224,806
Tap, W. Kenworthy ... 224,921
Telegraph and telephone systems, circuit and signaling apparatus for district, T. N. Vail ... 224,965
Telegraphs, alarm recorder for fire, I. P. Hasslenbeck ... 224,903
Tile paving, W. J. Mitchell ... 224,938
Tool handle, H. A. Moore ... 224,798
Torch, lamp, W. Killoran ... 224,909
Traction engine, O. H. Burdett ... 224,906
Truck, fire engine, C. T. Holloway ... 224,931
Valve for locomotive and other engines, throttle, H. Walkeys (r) ... 9,160
Vapor motor, E. L. Brady ... 224,705
Vehicle dash frame, G. M. Peters ... 224,792
Vehicle spring, W. Henry ... 224,906
Vehicle spring, M. Woodhull ... 224,980
Vehicle wheel sand band, M. Potter ... 224,796
Velocipede, B. P. Crandall (r) ... 9,095
Violin, E. Marx ... 224,934
Wagon body, N. Faught ... 224,909
Wagon, farm, R. J. Barrus ... 224,860
Wash bench, A. Severson ... 224,799
Wash board, S. R. Jenkins ... 224,928
Washing machine, Chambers & Vaughn ... 224,876
Watch chain swivel, J. L. Remlinger ... 224,802
Watches and clocks, hair spring stud for, B. L. Peabody ... 224,973
Water elevator, G. E. Bigelow ... 224,902
Wind wheel, H., Sr., & H. Croft, Jr. ... 224,911
Window, colored glass, J. La Farge ... 224,931
Window fastener, L. Stebbins ... 224,904
Window frame, S. H. Decou ... 224,916
Wire coiling reel, D. C. Stover ... 224,966
Wire drawing, T. O. P. Kenerson ... 224,979
Wire rods, reel for coiling, C. H. Morgan ... 224,941
Wire rods, reel for coiling, Morgan & Daniels ... 224,941
Wire stretcher, J. Fowle ... 224,902

DESIGNS.

Flowers, matches, etc., holder for, J. W. Tufts ... 11,660
Medal battery, J. H. Flanagan ... 11,656
Ornamenting metal surfaces, J. Hewitson ... 11,659
Spoon and fork handles, W. Rogers ... 11,657
Types, font of printing, W. W. Jackson ... 11,660

TRADE MARKS.

Chains, bracelets, collar and sleeve buttons, pins, and ear drops, F. G. Whitney & Co ... 7,908
Liver pad, Thompson, Schutt & Co ... 7,907
Milk, condensed, New York Condensed Milk Company ... 7,905, 7,906
Oils and oils for protecting polished metallic surfaces, lubricating and illuminating, De Forest & Driggs ... 7,903
Soap, C. S. Higgins ... 7,904

English Patents Issued to Americans.

From February 20 to February 24, 1880, inclusive.

Artificial marble, W. H. Hoopes, Baltimore, Md.
Axle boxes, T. Haynes, Kansas City, Mo.
Bearings for axles, etc., H. Loud, Everett, Mass.
Bed, J. H. Archer, San Francisco, Cal.
Cast iron, converting into wrought iron, L. D. Chapin, Chicago, Ill.
Cereals, products from, Cereal Manuf. Co., N. Y. city.
Cream collector, P. G. Peltret, San Francisco, Cal.
Middlings purifier, T. B. Osborne et al., New Haven, Ct.
Nut lock, I. D. Beach et al., Millersville, Mo.
Speed regulator for steam engines, J. B. Sheppard, Philadelphia, Pa.
Telegraph wire, manuf. of, A. E. Eaton, Brooklyn, N. Y.
Telegraph, preventing escape of currents, C. E. Chinnock, Brooklyn, N. Y.
Telephone conductors, C. E. Chinnock, Brooklyn, N. Y.
Valves for barrels, C. G. Singer, United States.
White lead, manuf. of, G. T. Lewis, Philadelphia, Pa.

Answers to Correspondents, embodying a large quantity of valuable information, practical recipes, and instructions in various arts.

Single numbers of the *Scientific American Export Edition*, 50 cents. To be had at this office and at all news stores. Subscriptions, *Five Dollars a Year*; sent postpaid to all parts of the world.

MUNN & CO., PUBLISHERS,
37 PARK ROW, NEW YORK.

To Advertisers: ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The Scientific American Export Edition has a large guaranteed circulation in all commercial places throughout the world. Regular Files of the Export Edition are also carried on ALL STEAMSHIPS, foreign and coastwise, leaving the port of New York. Address MUNN & CO., 37 Park Row, New York.

Advertisements.

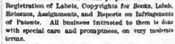
To Business Men.

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is ten times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. If it is worth 25 cents per line to advertise in a paper of three thousand circulation, it is worth $4 per line to advertise in one of forty-eight thousand.

The circulation of the SCIENTIFIC AMERICAN is guaranteed to exceed FIFTY THOUSAND every week.

For advertising rates see top of first column of this page, or address

MUNN & CO., Publishers,
37 Park Row, New York.



CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since September 11, 1866, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.
BRANCH OFFICE.—Corner of F and 7th Streets, Washington, D. C.

A New American Book on the Marine Steam Engine.
NOW READY.—SECOND EDITION.

A Catechism of the Marine Steam Engine,

for the use of Engineers, Firemen, and Mechanics. A Practical Work for Practical Men. By EMORY EDWARDS, Mechanical Engineer. Illustrated by sixty engravings, including examples of the most modern Engines. In one volume, 12mo. Price, $2.00, by mail, free of postage.

AMONG THE CONTENTS ARE: Introduction.—Qualifications for Engineers. Chapter I. Steam, Steam Engine. II. Boilers. III. Attachments to Boilers. IV. Smokestacks, etc. V. Glass Gauges. VI. Hydrometer, etc. VII. How to Set a Safety Valve. VIII. Corrosion of Marine Boilers. IX. Water-tube Marine Boilers. X. Repairs at Sea. XI. Abuse of Steam Boilers. XII. Testing Boilers. XIII. Explosion of Steam Boilers. XIV. Combustion, etc. XV. Marine Engines, Side Wheel. XVI. Marine Engines, continued. Screw Engines. XVII. Steam and Vacuum Gauges. XVIII. Surface Condensers. XIX. Sea Valves and Cocks. XX. Donkey Pumps. XXI. Compound Engines.—What is a Compound Engine; Rise in the Pressure of Steam carried in Marine Boilers with Increase in Expansion. Form of Boiler; Double Expansion or Compound Engine; The Steamship Tasmania; The French Steamships Ville de Paris and Pereire; The Cunard Steamships Batavia, Parthia, Bothnia, and Scythia; British Ships of War Tenedos, Briton, Thetis, Hydra, and Cyclops. Original Cost, Weight, and Space occupied by Steam Machinery on the Compound System. Advantages of Compound System; The Paddle-wheel Steamer Scotia, of the Cunard Line; The Inman Steamer City of Brussels. The National Line Steamer Spain; The Paddle-wheel Steamer Wolf; Vertical Inverted Direct-acting Compound Engines of Screw Steamers; Steamship Moselle. XXII. Steam Engine Indicator. XXIII. Expansion of Steam. XXIV. Cut-off-Beam Engines. XXV. Cut-off-Screw Engines. XXVI. How to Set a Slide Valve. XXVII. Marine Engines. XXVIII. Horse Power of an Engine. XXIX. To Put the Engine on the Center. XXX. Thumping of Engines. XXXI. Lining up an Engine. XXXII. Liners. XXXIII. On Coming into Port. XXXIV. Overhauling the Engine in Port. XXXV. Grinding-in of Valves, Cocks, etc. XXXVI. Packing, Gibs, etc., etc. XXXVII. Starting Fires, etc. XXXVIII. Firing. XXXIX. Foaming. XL. Repairs at Sea. XLI. Modern Marine Engines, Simple and Compound.—American and English Examples.—Engine, Boiler, etc., U. S. S. Mammoth, designed by Chas. W. Copeland (specifications in full); Engine of the S. S. City of Vera Cruz; Boilers; Engine of the S. S. Hudson; Comparative Dimensions and Power of the S. S. Hudson, New Orleans, and Knickerbocker; Marine Engine exhibited at the Centennial Exhibition, by Wm. Cramp & Sons; Engines of the S. S. Pennsylvania, Ohio, Indiana, and Illinois; Record of the Running of the S. S. Ohio; Compound Engines of H. B. M. S. S. Inflexible; Compound Engines of H. B. M. S. S. Dreadnaught; Compound Engines of H. B. M. S. S. Alexandra. H. B. M. Sloop Pelican, Engined on the Perkins High Pressure Compound System; Compound Engines of H. B. M. S. S. Rover; Three-throw Crank Engines of the Compound System, H. B. M. S. S. Boadicea and Bacchante, by G. B. Rennie; H. B. M. S. S. Nelson, H. B. M. S. S. Northampton. H. B. M. S. S. Devastation; Engines of H. B. M. S. S. Raleigh; Trials of H. B. M. S. S. Raleigh; Engines of H. B. M. S. S. Shannon; Weights of Machinery. Four-cylinder Compound Marine Engines of White Star S. S. Line; Engines of the Yacht Isa. Engines of the Largest Coasting Steamer in the U. S. APPENDIX. Useful Tables and other information for Engineers; Britton's Tube Flanger; The Pyrometer; Index.

The above or any of our books sent by mail, free of postage, at the publication price.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
No. 810 Walnut Street, Philadelphia, Pa.

PATENT
COLD ROLLED
SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburg, Pa.
190 S. Canal Street, Chicago, Ill.
Stocks of this shafting in store and for sale by
FULLER, DANA & FITZ, Boston, Mass.
Geo. Place Machinery Agency, 121 Chambers St., N. Y.


ALAND'S
Silent Injector,
Blower & Exhauster.
Apply to
S. ALAND,
Rome, Oneida Co., N. Y.


STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.

THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.

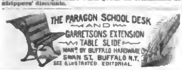
WORTHINGTON STEAM PUMPS of all sizes and for all purposes.

Prices below those of any other steam pump in the market.

WATER METERS. OIL METERS.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29 ST. NEW YORK CITY

JOHN R. WHITLEY & CO.
European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E. C. Paris, 8 Place Vendome. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.



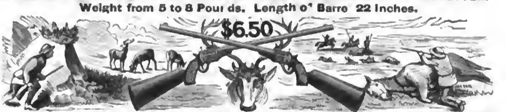
Steel Castings

From ¼ to 15,000 lb. weight, true to pattern, of unequaled strength, toughness, and durability. 15,000 Crank Shafts and 10,000 Gear Wheels of this steel now running prove its superiority over all other Steel Castings. Send for circular and price list.
CHESTER STEEL CASTINGS CO., 407 Library St., Phila. Pa.

Has More Good Points.
Does More and Better Work,
Takes Less Power,
Than any Hammer in the World.
BRADLEY & COMPANY,
SYRACUSE, N.Y.

A BREECH-LOADING REPEATING RIFLE FOR $6.50. THE IMPROVED "CHICHESTER."

Weight from 5 to 8 Pounds. Length of Barrel 22 Inches.



[illegible] CHICHESTER RIFLE [illegible] CHICHESTER [illegible] CHICHESTER RIFLES [illegible] CHICHESTER [illegible] CHICHESTER [illegible] BEAR IN MIND [illegible] REPEATER [illegible] FIRES SEVEN TIMES [illegible] CHICHESTER [illegible]

WE WILL SEND ONE CHICHESTER SEVEN SHOT REPEATING RIFLE [illegible] for $6.50 [illegible] by Registered Letter, Post Office Money Order, Draft on New York, [illegible] Make all Checks and Money Orders payable to CHICHESTER RIFLE CO. [illegible]

BLAKE'S CHALLENGE ROCK BREAKER.

Patented November 18, 1879.

For Macadam Road making, Ballasting of Railroads, Crushing Ores, use of Iron Furnaces, etc. Rapidly superseding our other styles of Blake Crusher on account of its superior strength, efficiency and simplicity. Adopted by important Railway and Mining Corporations, Cities, and Towns. First Class Medal of Superiority awarded by American Institute.

BLAKE CRUSHER CO., Sole Makers, New Haven, Conn.

THIRTY-FIFTH ANNUAL REPORT
OF THE

NEW YORK LIFE INSURANCE CO

OFFICE, Nos. 346 and 348 BROADWAY.

JANUARY 1, 1880.

Amount of Net Cash Assets, January 1, 1879 .... **$36,213,457.61**
Less deduction to cover decrease in value of U. S. Bonds and other assets $135,966.93
$36,077,490.68

REVENUE ACCOUNT.

Premiums	$6,380,875.05		
Less deferred premiums Jan. 1, 1879	374,839.89	$6,005,036.16	
Interest and rents	2,339,875.41		
Less interest accrued Jan. 1, 1879	306,225.03	$2,033,650.00	$8,036,686.16
			$44,114,176.84

DISBURSEMENT ACCOUNT.

Losses by death, including Reversionary additions to same	$2,360,854.22	
Endowments matured and discounted, including Reversionary additions to same	1,013,036.82	
Annuities, dividends and returned premiums on cancelled policies	2,836,379.47	
Taxes and re-insurances	175,808.04	
Commissions, brokerages, agency expenses and physicians' fees	606,233.30	
Office and law expenses, salaries, advertising, printing, &c.	307,100.11	$5,928,745.16
		$38,185,431.68

ASSETS.

Cash in bank, on hand, and in transit (since received)	$1,964,701.48	
Invested in United States, New York City, and other stocks (market value $14,356,192.94)	13,544,678.96	
Real estate	4,974,573.68	
Bonds and mortgages, first lien on real estate (buildings thereon insured for $14,287,000.00 and the policies assigned to the company as additional collateral security)	15,313,278.45	
Temporary loans, (secured by stocks, market value $1,300,000)	830,000.00	
* Loans on existing policies, (the reserve held by the company on these policies amounts to $3,160,000)	621,403.00	
* Quarterly and semi-annual premiums on existing policies, due subsequent to Jan. 1, 1880	369,489.00	
* Premiums on existing policies in course of transmission and collection (estimated reserve on these policies, $350,000, included in liabilities)	211,683.23	
Agents' balances	28,149.13	
Accrued interest on investments Jan. 1, 1880	317,269.11	$38,185,432.68

A detailed schedule of these items will accompany the usual annual report filed with the Insurance Department of the State of New York.

Excess of market value of securities over cost $11,520.98

CASH ASSETS, Jan. 1, 1880 .... **$38,996,952.66**

Appropriated as follows:

Adjusted losses, due subsequent to Jan. 1, 1880	$225,660.64	
Reported losses, awaiting proof, &c.	213,277.37	
Matured endowments, due and unpaid	30,780.58	
Reserved for re-insurance on existing policies; participating insurance at 4 per cent. Carlisle net premium; non-participating at 5 per cent. Carlisle net premium	34,016,840.82	
Reserved for contingent liabilities to Tontine Dividend Fund, over and above a 4 per cent. reserve on existing policies of that class	1,371,480.18	
Reserved for premiums paid in advance	16,543.23	$35,876,581.18
Divisible surplus at 4 per cent.		3,120,371.48
		$38,996,952.66

Surplus, estimated by the New York State Standard at 4 1-2 per ct., over $7,000,000.00

From the undivided surplus of 3,120,371.48 the Board of Trustees has declared a Reversionary dividend to participating policies in proportion to their contribution to surplus, available on settlement of next annual premium.

During the year 5,924 policies have been issued, insuring 17,098,173.

Number of Policies in force		Amount at risk	
Jan. 1, 1876	44,661	1876	$128,132,119
Jan. 1, 1877	45,421	1877	127,748,473
Jan. 1, 1878	45,605	1878	127,901,887
Jan. 1, 1879	45,005	1879	125,232,144
Jan. 1, 1880	45,705	1880	127,417,763

Death-claims paid		Income from Interest		Divisible surplus at 4 per cent.	
1875	$1,524,323	1875	$1,875,653	Jan. 1, 1876	$2,433,654
1876	1,547,648	1876	1,906,950	Jan. 1, 1877	2,626,816
1877	1,638,128	1877	1,867,457	Jan. 1, 1878	2,664,144
1878	1,687,676	1878	1,948,665	Jan. 1, 1879	2,811,436
1879	2,360,854	1879	2,033,650	Jan. 1, 1880	3,120,371

TRUSTEES.

THEODORE M. BANTA, Cashier.
D. O'DELL, Superintendent of Agencies.
CHARLES WRIGHT, M. D. } Medical
HENRY TUCK, M. D. } Examiners.

MORRIS FRANKLIN,
President.
WILLIAM H. BEERS,
Vice-Pres't & Actuary.


The Premium Bucket.

DUC'S IMPROVED ELEVATOR BUCKET.

Made in sizes from 3½ to 20 inches. For use in FLOUR, GRAIN, MALT, ORES, COAL, BROKEN STONE, SAND, DRUGS, SPICES, PLASTER, etc., etc. These buckets are struck out from the best charcoal iron, and are almost indestructible. No corners to catch. No seams to burst. Run with great ease and fill full every time. No interior corners to clog up.

T. F. ROWLAND, Sole Manufacturer, Brooklyn, N. Y.

COE BRASS MFG. CO.
WOLCOTTVILLE CONN.
BRASS AND COPPER IN SHEETS — WIRE AND BLANKS
MATERIALS FOR METALLIC AMMUNITION A SPECIALTY.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

SHEPARD'S CELEBRATED
$60 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.

H. L. SHEPARD & CO.,
331, 333, 335, & 337 West Front Street,
Cincinnati, Ohio.

Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

FIRE BRICK, TILE AND CLAY RETORTS ALL SHAPES
BORGNER & O'BRIEN.
23D ST. ABOVE RACE PHILADELPHIA

Pond's Tools,

Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

ROOTS' NEW IRON BLOWER.

POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED
IS SIMPLER, AND HAS
FEWER PARTS THAN ANY OTHER BLOWER.
P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 8 Dey Street,
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street, } NEW YORK.

SEND FOR PRICED CATALOGUE.

THE HOLLY SYSTEM OF STEAM HEATING
LOCKPORT N.Y.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
233 BROADWAY, NEW YORK.

The George Place Machinery Agency

Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

MACHINISTS' TOOLS.

Iron Planing Machines
A SPECIALTY.
C. WHITCOMB & CO., Worcester, Mass.

DO YOUR OWN PRINTING.

$3 Self-Inking Printing Press, with complete outfit, $3.50. 9 larger sizes. Catalogues and reduced price list free.
H. HOOVER, Philadelphia, Pa.

1880. 1880. 1880.

The Scientific American

FOR 1880.

THIRTY-FIFTH YEAR.

VOLUME XLII. NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Third day of January, 1880, a new volume was commenced. It will continue to be the aim of the publishers to render the contents of the new volume as attractive and useful as any of its predecessors.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

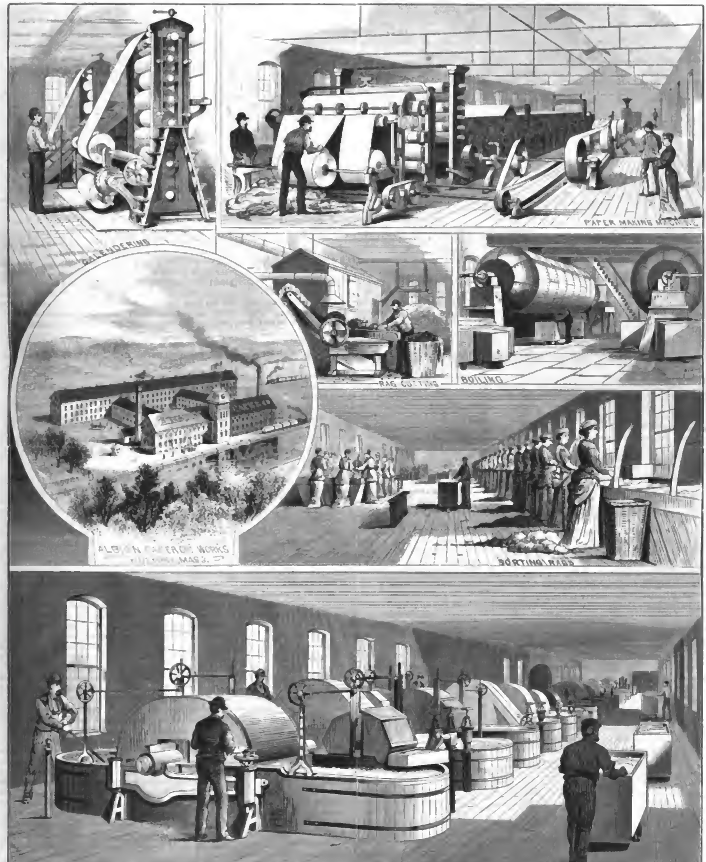
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 14. [NEW SERIES.] | NEW YORK, APRIL 3, 1880. | [$3.20 per Annum. (POSTAGE PREPAID.)]



THE MANUFACTURE OF BOOK PAPER—ALBION PAPER MILLS, HOLYOKE, MASS.—[See page 211.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, APRIL 3, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 222.

For the Week ending April 3, 1880.

Price 10 cents. For sale by all newsdealers.

AMERICA'S INDUSTRIAL SUPREMACY ASSURED.

"Every war, even a victorious war, is a national calamity." So writes the Count Von Moltke, Germany's most successful warrior. And he might have added: To be constantly preparing for war is a national calamity but little inferior to actual warfare. Last year Europe expended for military and naval purposes something near $800,000,000, and did no fighting. This great burden was borne chiefly by eight powers, as follows: Russia, $173,740,000; Great Britain, $152,510,003; France, $128,320,000; Germany, $101,626,000; Austro-Hungary, $56,074,000; Italy, $44,080,000; Spain, $28,560,000; Turkey, $23,800,000.

This profitless squandering of money—which the overtaxed producers have to furnish—is unfortunately not the whole of the blood tax upon Europe in times of peace. The national debts of Europe, due almost entirely to past wars and preparations for future conflicts, amount to more than twenty billion dollars, the interest of which the producers have to meet. About eighteen billions of debt stand against the eight powers above named.

This is the tax paid in money. That which comes from withdrawing able-bodied men from productive labor is an item of scarcely less magnitude, for the standing armies of Europe foot up something over eight millions. In a late report by the Hungarian ministry, designed to show the relative weakness of the Austro-Hungarian forces, the armies of the five chief States of Europe were enumerated as follows:

The military strength of Russia consists of 3,046,800 men, of whom 600,000 belong to the reserve and 2,446,800 to the standing army. The regular army of France comprises 1,089,000 soldiers of all arms, the territorial army, 1,208,000: total, 2,289,000; to be increased in 1892 by the addition of 500,000 reserve men to 2,783,000. The German power of all classes is represented by 2,004,300 men, of whom 1,076,200 belong to the standing army, 307,200 to the landwehr, and 620,900 to the reserve. Italy has an army of 699,000 and a militia of 310,000. In 1892, when the reserve will number 1,016,200, her total strength will reach 2,024,200. Austro-Hungary possesses a standing army of 800,000, a landwehr of 299,318, and a reserve of 95,000 men; total, 1,194,318. The grand total of all these forces amounts to 16,471,918, the standing armies alone numbering 7,925,000. To these figures there should be added for the armies of Great Britain, Spain, and Turkey, about 700,000 regular soldiers and twice as many reserves. Allowing that half of the men nominally in the European armies are at home on furlough, and able to take part in productive labor, there cannot be less than 4,000,000 men in the prime of life permanently withdrawn from productive industry in the great states named. Counting the labor of these men as worth no more than a hundred dollars each a year, the burden of their idleness can be measured only by hundreds of millions of dollars annually. Adding the value of the time lost by the millions of reserves in drilling, and the losses incident to the spoiling of men for peaceful industry by enforced soldiering during the years of early manhood, a rough idea can be formed of the aggregate burden which governmental ambition and mutual fear combine to lay upon the shoulders of Europe's working population.

Not the least disheartening feature of this state of things is its tendency to grow steadily worse. As a leading English journal pertinently remarks, it is the special aggravation of this waste of human energies that it is interminable, that it settles nothing finally, that the consequence of war is not peace, but a condition of further preparation, in which victory and defeat alike are used as arguments for further preparations. Germany is victor, and becomes a camp; France is vanquished, and becomes a parade ground. Germany is united and must therefore be drilled; Italy is united and must therefore be drilled; the Balkan peninsula is disunited and must therefore be drilled. Whatever the circumstances or the sacrifices or the hopes there must be more and ever more men drilled, more expenditure on preparations for war, more devotion by rulers to military work, more surrender of citizens to disciplinary training.

To this frightful extent Europe is handicapped in the race for industrial supremacy. It is the penalty which the people have to pay for the accidents of their geographical position, the forms of government they have inherited, and their worse inheritance of military history, national hatreds, and political entanglements. At the same time the ability of the European workers to meet these heavy obligations is being steadily lessened, not only by the drafting of their best brawn and bone into the armies, but by the voluntary expatriation every year of thousands of their more energetic sons and daughters.

The United States comprise about the same area as the great states of Europe combined, and already have nearly one fifth as many inhabitants. In all probability children now born may live to see United America equal in population to all Europe. From our continental position any great aggressive war in America by American men is altogether impossible, and the prospect of great civil wars is, we are happy to believe, not less remote. Our strength is rapidly becoming so great—if it is not already so—that no foreign nations are likely to assail us; and the aversion of our people to foreign entanglements is likely to keep us from offensive foreign wars.

The natural advantages of America for diversified and prosperous industries are certainly not less than those enjoyed by Europe; and our people are quite as capable as those of Europe of making the most of their industrial opportunities. The problem of industrial supremacy is, therefore, not hard to solve. The single advantage we enjoy in being free from the terrible war-burdens of Europe even in times of peace, and our practical exemption from risk of foreign wars, cannot fail to maintain us in our position as the most prosperous people in the world. The annual tale of labor prevented, labor misapplied, and labor driven away by the enormous armies and armaments of Europe finds no counterpart here. All our labor is productive, all tends to swell our national wealth, and to increase our power to do and to enjoy. This alone would insure our industrial supremacy, other things being equal, in a very few years; and fortunately our freedom from Europe's military burdens is but one of the great blessings we have to be thankful for—but one of the conditions which go to make sure our superiority in productive power—our supremacy in the arts of peace. And the advantage of all this must and does accrue mainly to the American producer, showing itself in lighter taxes, higher wages, a greater diffusion of wealth, and a more generous style of living; all of which are everywhere recognizable by European tourists here as characteristic of the lives of American workers.

PROTECTION FROM YELLOW FEVER.

"Out of sight, out of mind," has been too much the rule in regard to this matter. Two successive years of severe visitation of this dreadful disease at New Orleans and Memphis each time drew general attention to the necessity for some action in the way of prevention, but with its disappearance the matter appears to have passed almost completely out of the public mind. Doctors are by no means agreed as to the best method for its treatment, nor as to its original cause, and just how it is propagated, other than by contact with the developed disease or its germs, our knowledge is very limited. The fact that stands out most prominently in connection with the subject is that the island of Cuba, and particularly the city of Havana, seem to be its chosen home, and in the latter city the disease has been present each month in the year for every year since 1850.

For the purpose of adding to our specific information in regard to yellow fever the National Board of Health last year sent a special commission to Cuba, whose preliminary report has just been published. What they have furnished does not throw much light on the pathology of the disease, but the facts they present as to the sanitary condition of the island are such as should compel our authorities to erect more effectual barricades than have yet been provided against this pest-house at our very doors. It is impossible to say when the disease first occurred there, but it was first known as an epidemic in Havana in 1761 and 1762, and from that time to this that city has been its principal headquarters, it being generally epidemic there from June to October. The poison is always present, the climatic conditions favor its development, the government takes no practical measures to eradicate it, and the sanitary state of a large portion of the city, as described by the commissioners, is bad almost beyond belief. Many of our citizens go to Havana every year, but it is only a small section of the city that foreigners ever visit, and none will be more surprised than those who have been there at what is said in the report of the actual condition of the greater part of the city.

The water is very impure, and so insufficient in quantity that "a large portion of the population purchase their water daily in kegs and carboys from street venders." The streets are not paved, except in about one-fourth of the city; many of them are so narrow as to afford room for but one vehicle, and in but few cases have any sewers, while the most of these are so filled with solid materials as to be inoperative. Nine-tenths of the houses are only one story high, many of them having the sleeping rooms adjoining the kitchen, privy, and sometimes a stable. Most of the floors are of brick or stone, on a level with or below the streets. "The privy is almost a part of the kitchen; it consists of an excavation, which often extends several feet under the flags of the court; it is never emptied until it will hold no more, which seemed generally to be from five to ten years; it has no ventilating pipe, and belches forth its nauseous odors at times even to the front door . . . In the summer season a fæcal or urinary odor prevails generally, and is distinctly perceptible as it oozes from the doors and windows of almost every house." Notwithstanding that the houses are so mean, rents are very high, as are all to the expenses of living. The government is greatly in debt, its credit is poor, and the taxation very oppressive. On this account any material improvement in the sewage system is hardly to be looked forward to, it being estimated that to make this effective, provide a proper water supply, etc., "to correct some few of the most glaring insanitary evils," would cost $20,000,000. There are many other places in the world that are no cleaner than Havana, and where the temperature is as high or higher, but where the yellow fever never comes, as Canton and Bombay, for instance, and one of the suggestions made in the report is that possibly the alkalinity of the air of Havana has much to do with the prevalence of the disease. The atmosphere of the city is constantly alkaline, but this condition is especially marked during the summer months, and the times of high atmospheric alkalinity coincide with the greatest intensity of yellow fever.

Under these conditions it is quite plain that any protection we have from constant visits of this disease must come from a more stringent regulation of our commercial intercourse with Cuba, as substantially the same circumstances exist in most other Cuban ports as at Havana, though in a lesser de-

gree. Our government endeavored to do something in this direction by the law of June 2, 1879, which provided that our consuls in foreign ports should see that every vessel bound for the United States should comply with the rules and regulations necessary "to secure the best sanitary condition of the vessel, cargo, passengers, and crew," and prohibiting the entry here of any vessel not provided with a prescribed "certificate required to be obtained at the port of departure." In Cuba this law was denounced and its enforcement rendered impracticable, so that it has remained a dead letter. It is evident, therefore, that something further should be done in the way of enforcing a more stringent supervision than is at present exercised on vessels leaving Cuba for the United States, for, with our present exposure we are constantly running the risk of a pestilence which may, in some particularly trying year, be brought thence to our Atlantic cities. Our commercial intercourse with Cuba, important as it may be deemed, should not be considered of sufficient moment to justify our taking any further risks of this kind.

CHEAP PATENTS CHEAPEN GOODS.

The attorneys of anti-patent associations waste no end of rhetoric in describing the burdens put upon purchasers by the multiplication of patent rights. Everything is patented or made with patented machinery or by patented processes; therefore everything must cost a great deal more than it would were there no patents. This is their logic stripped of verbiage. The only fault with it is the persistence of facts in always going dead to the contrary. It is plausible, but it is not true. The moment one sees the word "patented" stamped on an article it is safe to infer one of two things: either the thing is cheaper and better than anything of the sort previously in market, or it is an entirely novel article, which in all probability would never have been produced except for the patent laws.

A pretty illustration of this industrial and commercial paradox occurs in a paper lately read by a prominent English builder before the Manchester (England) Scientific and Mechanical Society. The reader had been, for the second time, comparing English with American made builders' hardware, showing the "marked superiority" of the latter, and was summing up the causes which had led to the competition upon their own doorsteps from American manufacturers. He said:

"Another and most important factor in the sum of deadweight under which we have to stagger in this race is our absurd patent laws. If our legislators had set out with the intention of suppressing the inventive genius of the country, they could not have succeeded more completely than they have done. Can we wonder that America is such a close competitor in the manufacture of these small articles, when we know that for a payment of £18 the inventor can secure himself for seventeen years, whilst in this country it will cost at least twice the money to secure an invention for three years only? How can a man with inventive skill, but with limited means, make the most of his talents? Too often he spends all his little savings, ruins himself, and, when his three years have expired, sees some other person take his invention in hand and realize the profit that belongs to himself. The result is that, disheartened and disgusted, he for ever after buries his talent in the earth. I show you here a small article of American make, not connected with the building trade, as an illustration of the different influence of the patent laws of the two countries. This little machine (an apple parer) carries eight patents, yet its wholesale price in England to-day is less than 4s."

A most ingenious paradox, truly!

The apple-parer was beyond English competition because it carried eight patents. It is safe to say that every single patent had improved its working or lessened its price.

But why could not the English manufacturer, having no patent royalties to pay, produce and sell the article on the spot cheaper than the American, with 3,000 miles of freightage to pay in addition to the cost of manufacture? There may be several reasons more or less sufficient; but one is enough. Having no monopoly of the manufacture, the Englishman could not afford to risk the investment necessary to enable him to produce the article cheaply.

Our Canadian friends discovered that law of trade when they undertook to reap the benefit of Yankee inventions without payment of patent royalties. The only drawback was the simple circumstance that, though Canadians had the world's best inventions to choose from gratis, no man dared to undertake the manufacture of novel articles when everybody else was free to set up in opposition. Canadian industries would not multiply until the Canadian Government recognized the property rights of all inventors; then the Canadians began to be a manufacturing people.

Our Western and Southern citizens are rapidly learning the same important lesson. Industries increase and multiply, and industrial products improve and cheapen in direct proportion to the number of patents issued; and the number of patents issued depends very largely upon the lowness of the official fees for issuing them. Which brings us round to our thesis, that cheapening patents cheapens products.

American Manufacturing Industries.

There are few qualities in one's nature more objectionable perhaps, than egotism, but it is difficult to withhold from others the pardonable pride we feel in referring to the superior engravings which our artists produce each week for this paper.

We allude, especially, to the series of full page engravings, illustrative of the most prominent American industries. The present issue, containing the article on book paper making, is the thirty-seventh of the industrial series which have already appeared in these columns. The views of the several manufacturing establishments we have illustrated were sketched by our own skilled artists on the premises, and for accuracy and artistic grouping of the interior views, showing the various processes of manufacture, we believe there has been nothing attempted before in journalism that has met with the same gratifying success which has been accorded to this interesting feature of this paper.

A continuation of this industrial series we purpose to continue until every important industry of the country has been illustrated and described, and we would thank our readers to suggest what extensive works in their vicinity would furnish interesting material for publication.

NEW YORK ACADEMY OF SCIENCES.

A meeting of the New York Academy of Sciences was held Monday, March 15, at 8 P.M., President Newberry in the chair.

Mr. Kunz exhibited a necklace made of beautiful iridescent shells, and also several handsome pearls from fresh water mussels found near Portland, Maine. Mr. McCarty exhibited several minerals.

The Recording Secretary, Prof. Leeds, read a letter from Norman Lockyer, in which the latter expressed his thanks to the Academy for his election as an honorary member.

THE COAL AND IRON RESOURCES OF VIRGINIA.

The paper announced for the evening was on the coal and iron resources of Virginia, by Prof. Thomas Egleston. The following is a brief synopsis of it:

When Alsace was separated from Lorraine the commissioners drew the boundary in such a manner as to give to Germany all the iron lands and leave nothing of value to France. In like manner the division of Virginia left all the iron in the old State and gave the new one all the coal. These are not, however, the only mineral resources of Virginia. Gold, small quantities of silver, lead, and zinc are also found. Near Wythevill, particularly, the zinc ore rivals that of Friedensville near Bethlehem, Pennsylvania. It appears to be very free from lead, and the zinc made from it has been commanding more than double the price of the common metal in the market.

The great iron region of Virginia lies between the Alleghanies on the west and the Blue Ridge on the east. The space thus inclosed consists of a number of shorter ranges, abounding in limonite, hæmatite, specular iron, and especially on the James River region, in magnetite. For magnitude of extent and facility of exploitation this region is second to none in the United States. As we ascend the successive terraces of the mountains we find the iron deposits folded so as to form numerous outcroppings succeeding each other at short intervals. Over 80 ores coming from the region between Staunton and the James River were analyzed, and none of them contained over 1·2 per cent of phosphorus. Most of the ores contain only from one to five-tenths of one per cent of phosphorus. A year ago Bessemer engineers would have considered this circumstance a great advantage; but with the new processes larger quantities of phosphorus are rendered available and even necessary to obtain the requisite degree of heat in the converter. Taking the whole iron region together the ore will average from 45 to 55 per cent of metal.

To the west of the iron district there are very extensive limestone deposits, and as we enter West Virginia we strike the coal measures. There is a belief current in that region that it is only the lower coal that will coke well, but this is an error. Coal has been found there that will give only two per cent of ash, and the coke formed from it gives but six per cent. As we leave the river banks the coal deposits increase in thickness, until they reach a depth of twelve feet, as, for example, at Hawk's Nest. The valley of the Kanawha River is not one of erosion, but was formed by a geological accident. As a consequence of this the mines that have been started along the banks will have to be abandoned sooner or later and carried over the hills further inland to follow the veins.

It is impossible to tell how much coal there is in Virginia, and nowhere is there so little known about it as in Virginia itself. Since Prof. Roger's report, in 1838, no systematic explorations have been made on account of the difficulty of access. For the want of facilities for transportation, the few iron furnaces that have been run from time to time in Virginia have used charcoal at great expense. During the war the Confederate Government was particularly unfortunate in locating its furnaces near ore containing an exceptionally large amount of phosphorus which they did not then know how to manage.

If the present great revival in the iron trade should continue greater efforts will, no doubt, be made in a few months by the railroads to open up these great mining regions; combinations will be formed between the iron interests of Virginia and the coal interests of West Virginia, and the effect will be to raise the district to the importance of the Pennsylvania iron and coal regions. Then surveys will be made either by private enterprise or by the governments of these States, and the capital of the country will pour in, producing a prosperity such as Virginia has never had. At present these deposits are but dormant wealth for a future generation.

At the conclusion of the paper Mr. Warner gave the fruits of his researches into the mysteries of the "fifteen puzzle," in the shape of a method of determining by inspection whether a given arrangement is or is not capable of solution.

C. F. K.

Proposed Exploration of Mexico.

It is announced that Mr. Pierre Lorillard, of this city, has entered into an agreement with the French Government to assist in the prosecution of a scheme of exploration among the ruins of Mexico. The French Government furnishes the outfit of the expedition and $10,000 in money; Mr. Lorillard gives $30,000 at once, and as much more when it is needed. The whole cost of the expedition for two years is put at $60-000. M. Charnay, the French scientist and explorer, will take charge of the work, which will begin next spring. The material results of the exploration will go to swell the treasures of the French museums. The report of M. Charnay will be first printed in the *North American Review*.

The field to be explored is rich in relics of the splendid though partial civilizations which had flourished for unknown ages, and were in part declining, if not forgotten, when the Spanish conquerors arrived. But, since the days of the ill-fated Maximilian very little has been done toward their investigation except by our government surveyors in Colorado, New Mexico, and Arizona. These have found evidences of an antiquity for the origins of the civilizations of ancient Mexico far exceeding anything dreamed of a few years ago; and it is altogether probable that the questions of historic and prehistoric interest raised by such discoveries may be materially helped on toward solution by the labors of M. Charnay. At least, he cannot fail to add much to our limited knowledge of the later civilizations of Mexico, as shown in the ruins of the Aztec and Toltec cities destroyed by the Spaniards.

Road Engines and Wagons for Western Transportation.

A number of road locomotives and trains of wagons, for the transportation of minerals and general merchandise over the common roads of the far West, were received in this city by the steamship Erin the latter part of February. They were built in Rochester, England, and were consigned to Wadsworth, Nevada, where they are intended to take the place of mule trains on certain central routes in that State.

The engines weigh about 7 tons each, and are rated at 12 to 14 horse power. They have horizontal boilers, which are fitted with large fire boxes for burning almost any description of fuel, and water tanks are affixed capable of holding a supply for three or four hours. The engines are so arranged that they can be used for turning fixed machinery. The driving wheels are 7 feet in diameter and 12 inches in width, and the steering or front wheels are 4 feet in diameter and 9 inches wide. An important advantage in the road locomotive is that in case of need the road wheels can be replaced by the ordinary flange wheels for running on rails.

With the addition of a winding drum, fitted to the driving axle, capable of holding from 50 to 100 yards of coiled rope, these engines can be employed in hoisting heavy weights and in hauling the loaded wagons up otherwise impracticable grades.

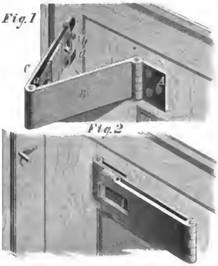
It is claimed that one engineer and two laborers are all the manual force necessary for the management of each train, and on moderate roads, with grades not exceeding 1 foot in 12, each engine of the size sent to Wadsworth will haul from 10 to 12 tons of paying load, and travel at an average speed of 3½ miles per hour. Two or three wagons, each capable of containing from 5 to 6 tons weight, and the engine form the train. The wagons are coupled together and to the locomotive by strong coupling bars, and the whole train follows exactly in the track of the engines, even when turning sharp curves. The total cost of hauling by the road locomotives, it is estimated, will range from 5 to 10 cents per ton per mile, varying with the condition of road and load. This is probably not one-fourth of the cost of doing similar work with mules. The ordinary mule team, consisting of 16 mules, with heavy wagons capable of holding 6 to 10 tons, will not average more than 2 miles an hour. The first cost of the locomotive, with its train of wagons, compares favorably with the first cost of the mule team and wagons. It is believed, however, that it will be many years before the traction engines can abolish the use of mules on the Western roads, as the latter may be employed where it would be difficult, if not impossible, for the engines to travel.

The Electric Middlings Purifier.

A public exhibition was given in New Haven, March 13, of the electric middlings purifier, the joint invention of two young men of that city. The working of the device is said to have been highly promising. Over the wire bolting cloths are placed a bank of hard rubber cylinders, which are slowly revolved against strips of sheep skin and thus electrified. To these rollers the light bran is attracted, to be mechanically brushed into a proper receptacle. This substitution of electric attraction for the air blast in separating bran from flour is said to lessen the waste, while it obviates the necessity of doing the work in a closed chamber and the risk of explosions. The exhibition was made in an open room, and there was neither dust nor waste.

SIMPLE BURGLAR ALARM.

The engravings show a novel alarm recently patented by Mr. Thomas Powell, of Philadelphia, Pa. The inventor has aimed to avoid all objectionable features in these simple and effective little devices, both in regard to appearance and convenience in handling and using. They will meet a long existing want. Only a second of time is required to put them in or out of condition for use. They are applicable to either doors or windows.



POWELL'S WATCHMAN OR BURGLAR ALARM.

Figure 1 is a perspective view of part of a door and door jamb with the alarm set ready for use. Fig. 2 shows the alarm folded against the door so as to be inoperative. Fig. 3 shows the application of the device to a window.

The alarm consists of three plates, A B C, the plate, A, being secured to the door; the plate, B, is hinged to the plate, A; and the plate, C, is hinged to the plate, B. The detonating device, which gives the alarm, consists of two strips, *a b*, of stout paper or cardboard, one overlapping the other, the overlapping portions being bound together by a band so that one strip can be pulled away from the other, creating friction, which causes the explosion of fulminate interposed between the overlapping portions.

The ends of the detonating device thus formed are perforated; one end being held by a stud projecting from the inner surface of plate, C; the other end adjusts itself, when set for use, upon hook, *d*, projecting from the door jamb. When the door is opened the fulminate is exploded, plate, B, being held in position, as shown in Fig. 1, by a lug projecting from its inner side.

In applying the alarm to windows the metallic portions of the device are modified to adapt them to the sliding motion of the window, as shown in Fig. 3. Here the plate, A, is hinged to the side of the plate, C, and a pin, *e*, driven into the casing, is used instead of the hook, *d*.

When the window is raised the hinged plates are carried upward with it, and the detonating device is separated, exploding the fulminate. The same result follows the lowering of the upper sash.

Further information will be furnished by Messrs. Thomas Powell & Co., 521 Cherry street, Philadelphia, Pa.

THE "NEW PATTERN" BLAKE CRUSHER.

The annexed engraving is a sectional view of one of the improved "new pattern" crushers manufactured by Messrs. E. S. Blake & Co., No. 1 Sixth Street, Pittsburg, Pa. It will be noticed that the machine is much more compact than its predecessors, and some of the parts appear to be, and really are, much lighter than in the old machines. This important difference is due to the substitution of wrought iron for cast iron. The most noticeable change is in the pitman, which is now made mainly of wrought iron, reducing it to about one-fifth the weight of the cast iron pitman. This improvement, besides thus lessening the weight of one of the moving parts of the machine, insures it against expensive breaks. Wrought iron has also been substituted for cast iron to a large extent in the frame or bed of the crusher, thus greatly reducing the weight, difficulty of handling, and cost of transportation. Another important improvement has been made in the toggles, so that they work without friction or wear and without the application of lubricants.

In almost all work requiring the use of a crusher, a degree of uniformity in the product is respect to fineness and coarseness is desirable; and it is desirable also that the uniformity shall be maintained without frequent manipulation of any part of the machine. Under the old construction and arrangement, so rapid is the wear of the toggle ends and their bearings, that a frequent drawing up of the "wedge," or the insertion of longer toggles, is necessary in order to maintain in any good degree a uniform distance between the jaws and consequent uniformity of product. But with the improvement to which we have referred, there being no wear of toggles or their bearings, there can be no change in the distance between the jaws except that which results from the wear of the jaw plates; this being extremely slow (in most cases requiring weeks, and in some cases six to twelve months to become appreciable), the variation of distance between the jaws in the improved machine must be correspondingly slow, in many cases amounting to almost nothing.

It will be understood, however, that when a change is desired in the fineness and coarseness of the product, it can be effected by substituting in the usual way longer or shorter toggles, a full set of which of different lengths is supplied with each machine.

In the 15x9 "new pattern" crusher, the pitman (single casting) weighs nearly 1,000 lb. This immense mass of iron has, of course, to be actually lifted at every revolution of the flywheels. The proper number of revolutions for this machine are officially given as 250. It is easy to see that in the old construction a large amount of power must be consumed in throwing this nearly a half ton of iron upward and around at the rate of 250 times a minute. In the improved machine the wrought iron pitman weighs less than 200 lb.

The difficulty of providing an inexpensive "break-down place" in the old "new pattern" Blake Crusher has always been strongly felt as a serious one. And when that style of machine was first offered to the public, the apprehension of expensive parts of the machine (namely, the frame, jaws, and shaft) being fractured by undue, accidental strains led to the addition of an amount of material to these parts which would doubtless have been regarded as quite unnecessary except for the reason referred to, the design of the addition being to throw the liability to fracture on the toggles, as the least expensive of the parts. It will be seen from the engraving that the large bolts which connect the cap or upper box of the eccentric with the parts below, furnish a most desirable, and the best possible protection against injuries to expensive parts of the improved machine. The bolts are made of sufficient strength for all ordinary and legitimate work, but relatively weaker than the other parts; and in the event of any abnormal strain endangering the parts, the weaker of the two bolts will give way, and thus no damage be experienced beyond breaking a single straight bolt, duplicates of which are furnished with each machine.

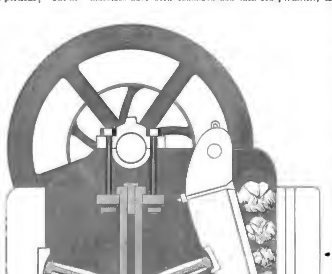
Another improvement consists in the use of friction rollers under the journals of the main shaft, a device which very largely reduces the amount of power required to drive the machine.

The manufacturers anticipate that some of the smaller crushers can be conveniently driven by horse power.

Patents for several of the improvements are pending, while on others patents have been already allowed.

The new machines have been examined and their construction approved by experienced mechanical engineers, and, as might be supposed, are finding a ready sale.

It is a point of no small importance in a crushing machine that the material to be crushed should, in feeding, not require to be elevated. It will be seen that in this respect the Lion and Eagle Crusher, as the manufacturers call it, has the same advantage as the old styles of the Blake machine.



THE IMPROVED "NEW PATTERN" BLAKE CRUSHER.

MECHANICAL INVENTIONS.

Mr. Nikolaus Kaiser, of Grellingen, Switzerland, has patented an improved mode of drying paper and pasteboard in continuous strips, and in the apparatus employed for that purpose. Heretofore the paper coming from the pressing machine, or other machines, was led over heated metal cylinders, which had the disadvantage that the paper became more or less brittle, thus rendering impossible the use of mechanically ground unboiled wood fiber without other admixture, and also that the cost of plant and working was considerably increased by the necessary employment and working of the expensive metal cylinders required for the purpose. This invention is designed to obviate these defects.

SIMPLE BURGLAR ALARM.

Mr. Frank H. Lauten, of New York city, has patented improvements in feeding paper and other material to printing presses and folding machines, the blanks to the forming and shaping machine for making paper boxes and bags, ruling machines, and for other similar machines wherein the paper or other material requires to be fed in single sheets continuously and in harmony with the operative mechanism of the machine. The improvements also comprehend devices for adjusting the paper on the apron.

An improved machine for cutting the corners of books, cards, and paper has been patented by Mr. Wm. T. Pringle, of New York city. It is of very simple construction and well calculated for the work it is intended to perform.

Mr. Henry L. Russell, of Bloomington, Ill., has invented an indicator lock especially designed for fire alarm boxes, railroad switches, etc., where it may sometimes be desirable to know who unlocked it last, that must be opened with numbered keys, and will register the number of the key that last unlocked it.

Messrs. Richard H. Briggs and James H. Dougherty, of Whistler, Ala., have patented improved mechanism for making ladder irons and hand-holds for freight cars. The machine consists of an ingenious combination of devices which cannot be clearly described without engravings.

An improved cider press, patented by Mr. Gottlieb Ziegler, of Paris, Ohio, will press the juice from any quantity of pomace that may be required without changing the parts of the press. It is also adapted to work more rapidly than the presses now in use.

An improved gate hinge is patented by Mr. James E. Davis, of Palmyra, Ohio. This hinge is designed for the class of gates that are opened by running them back and then swinging them around. It consists in a gate hinge formed of a screw hinged to a pintle provided with a small pulley and placed within a large ring pulley.

Mr. Garritt M. Van Riper, of Bodie, Cal., has patented an improved band sawing machine for cross cutting. The invention consists in a band saw working on pulleys that are fitted movably on vertical shafts, whereby the saw can be moved downward to cut from a log two blocks at once.

An improved paper pulp screen, patented by Mr. Benjamin F. Warren, of Cumberland Mills, Maine, is designed to pulsate the pulp in a simple and effective manner, and it may be adjusted to vary the pulsations as required.

An improved turbine water wheel has been patented by Mr. William H. Farrar, of Greensborough, N. C. This invention has for its object to provide an improved turbine water wheel which shall be simple and inexpensive in construction, but strong, durable, and capable of running at comparatively high speed with moderate pressure or comparatively low head of water.

Messrs. David H. and Jerome H. Payne, of Troy, N. Y., have patented an improved pulley for suspending clothes line.

The line with clothes hanging upon it can be easily pulled around without injury to the clothes.

AMERICAN INDUSTRIES.—No. 37.

THE MANUFACTURE OF BOOK PAPER.

It is a remarkable circumstance that paper made from rags should have replaced parchment, papyrus, and the whole range of substances used for making records, and come into general use just at the time of the invention of printing, and it is singular that nothing but paper will answer the requirements of the printer.

It is impossible to place definitely the date of the invention of paper. It is one of the things that originated in the remote and hazy past, and like many other things connected with human economies it has been gradually developed and perfected until every condition and requirement in its use seem to have been fulfilled.

It is probable that the first paper from pulp was made in China, and that from thence the art spread over the world. It is not even known when or where linen paper was first made, but it was generally in use about the middle of the fourteenth century.

Until within about a hundred years all paper was made by hand by a slow and laborious process, the supply was naturally limited, and the quality necessarily lacking in uniformity; but the trade was completely revolutionized by the invention of the Fourdrinier machine, by Louis Robert, an employe in the paper manufactory of Francis Didot, in France, in the year 1798. The credit of making the machine practically useful belongs to the Messrs. Fourdrinier, of London, from whom the machine takes its name. The machine was improved in various ways until, in 1806, it was so far perfected as to reduce the cost of paper to about one quarter of the former price.

Within the last fifty years many important improvements have been made in the manufacture of paper. These include the pulp dressing machine; the steam driers attached to the Fourdrinier machine; the rotary cutters which cut the web into any required width, and many other minor yet essential improvements which conduce to the present perfection of paper-making machinery.

Another comparatively recent improvement is the machine for supercalendering, consisting of four paper rolls and four well polished iron rolls, arranged in alternation and placed vertically one over the other. These machines are used for glazing fine papers such as ledger, flat, writing, and fine printing papers. In some instances chilled iron calender rolls are attached to and form a part of the machine, but this arrangement is used only for the lower grades of paper.

Space will not permit of a detailed history of the paper making industry; we have therefore chosen a representative establishment to illustrate the development of this branch of manufacture.

The Albion Paper Company, of Holyoke, Mass., was organized in 1869, when they bought the old wooden mill formerly owned by the Hampden Paper Company of the same place. The mill then had a capacity of 3,500 lb., which was soon increased to 5,000 lb. daily, and the product was used in the manufacture of paper collars. About eight years since the product of the mill was changed to supercalendered book paper; and in 1878, a parcel of land with water power adjoining the old mill was acquired, and a new and extensive brick structure was erected and supplied with the most modern and improved machinery, capable of turning out five tons of paper daily. A year later a second mill similar to the first was built, and filled with the same kind and amount of machinery, excepting that three engines more were added and a few improvements were made. These buildings are shown in the bird's-eye view at the left of the large engraving.

The main mill is 330 feet long by 34 wide and two stories high, with basement and attic. The bleach boilers and rag engines are in the first story, while the second story and attic accommodate the arrangements for sorting and dusting rags. From this building two wings, each 34 feet wide, containing the machine rooms, extend forward 104 feet, and connect with a building parallel to the main mill and forming the street front of the whole structure, which is thus in the form of a quadrangle inclosing an open court. The front building is 210 feet long by 34 deep and two stories high, with attic. The front is relieved by a square tower in the middle, and a similar tower at the rear of the rear mill contains stairways and elevator.

The buildings are so planned that neither stock nor finished paper has to pass over the same ground twice. The Holyoke and Westfield Railroad discharges rags and other materials at the rear, which, in the process of manufacture, pass forward to the finishing room, from which the paper is shipped.

The equipment of machinery, all of which is made in Holyoke, is very complete and modern. Five steam boilers are used to supply the four rotary bleach boilers, each of which, 21 feet long, has a capacity of five tons of rags. The engine room, besides these bleach boilers, contains thirteen 1,000 pound engines and two Jordan engines. There are two Fourdrinier machines, one of 84 and the other of 86 inches; four stacks of supercalenders, 38 inch face, 9 rolls to the stack, one stack, 40 inches face, and a stack of sheet calenders; seven Hammond cutters, and two Cranston trimmers.

The water power from the second level canal is utilized by several of the Holyoke Machine Company's Hercules Wheels. The mill employs 265 hands. It makes some engine sized flats, but is run mainly on fine book paper, all of which is supercalendered. The buildings are provided throughout with the new automatic sprinklers, which, in case of fire, floods the rooms the instant the heat becomes sufficient to melt the solder which holds the valve.

The material from which the paper is made, in its course through this manufactory, follows a regular order constantly advancing from the place of the entrance of the raw material to the place of exit of the finished product.

The stock is carried by elevators to the attic, where it is first put through an opener or duster, which whips out the greater portion of the dust contained by the rags, opens the folds, and puts them in condition to be examined and assorted. From the attic the stock is dropped to the floor below, where it is placed in baskets and distributed to women to be assorted and divested of buttons, hooks and eyes, pins, etc. After this it is spread out upon large tables and looked over carefully, and pieces of wood, rubber, and other substances likely to injure the paper are removed. The department in which this work is done is represented by one of the views in our engraving.

The stock is now carried forward to the cutting machine (shown in one of the smaller views), which rapidly cuts it up into small pieces, after which it is dusted and let down through hoppers in the floor into huge bleach boilers (shown in the engraving), where they are sealed up and subjected to the action of lime and steam for twelve to eighteen hours. These immense boilers are constantly revolved at a slow speed to bring all of the stock under the action of the bleaching agent.

After this operation the stock is conveyed to the washing engines, where it is washed for six or eight hours, according to the quality; it is then bleached by the application of bleaching powders, after which it is allowed to run through valves in the bottoms of the washers to brick drainers in the basement, where it is allowed to remain from two to four weeks.

The half stock, as it is now called, is put into the beating engines, where the fiber is brought out to the required length. Of these machines the Albion Paper Company have six, also seven washers, making a total of thirteen engines. The lower view in the engraving represents the long row of engines used in the establishment. In these engines the rags are drawn between the cutters on the large revolving cylinder and the stationary cutters in the bottom of the vat, and are torn into the finest filaments. The stock goes round and round in this machine, being acted upon by the cutters again and again, the huge cylinder carrying the cutters being meanwhile gradually lowered by the mechanism seen at the side of the vat, until the stock is reduced to a fine pulp. The thin pulp is allowed to run out of the engines into wooden chests, whence it is pumped up into the tank of the Fourdrinier machines. From this tank the pulp flows into a small chamber, where it is kept in constant agitation until it flows out over a channeled plate—upon which extraneous matters of greater specific gravity than the pulp are arrested—and is delivered to an endless wire cloth apron, which is continually agitated to insure an even distribution of the pulp fiber. The wire cloth apron is supported on a series of small rollers, and the width of the paper is governed by deckle straps at each side. The wire cloth apron passes over a box in which a partial vacuum is maintained, which withdraws a part of the moisture from the paper as it passes over the box.

The paper is delivered by the wire cloth apron to a felt apron, which conveys it to the first pair of press rolls which expel the moisture and deliver it to an apron which carries it forward to a second pair of press rolls, where more of the moisture is removed and the web is still further compressed; it is then passed to another blanket which delivers it to a series of steam-heated rolls. These rolls, as well as the other portions of this machine, must move in absolute harmony, and the mechanism must be of the most perfect character to handle the thin and extremely tender web of moist paper. The paper, as it is delivered by the machine, is in rolls. This mill has two Fourdrinier machines, one producing paper 76 inches wide, the other 79 inches wide. These machines are of Rice, Barton & Co.'s make. The paper is cut into different widths, as it is delivered to the reels, according to the requirements.

The finishing room adjoins the machine room, and all of the paper is passed through the calender rolls until a high finish is obtained.

The machinery of the Albion mills consists of 13 (1,000 lb. each) engines; two Jordan engines; four rotary boilers for rags having a capacity of five tons each; two Fourdrinier paper machines (84 and 86 inches wide). The calenders consist of four stacks having 9 rolls each, 36 inches wide; one stack 40 inches wide; one stack for calendering sheets.

The capacity of the mills is twelve tons of book paper per day.

The water supply, which must of necessity be pure and clean, is derived from driven wells, 165 in number.

The officers of the company are as follows: Calvin Taft, President; Edward C. Taft, Treasurer and Agent; A. H. Page, Clerk. These gentlemen also comprise the stockholders of the company. The entire mill is under the management of Mr. William Reardon.

Habits of Fishes.

It has been long known that fishes return to about the same place in the same rivers each year to spawn, but it is a recent discovery that they go up the left hand side of the stream and coming down take the opposite side. Fisher men may be benefited by remembering this.

Correspondence.

The Value of Vaccination.

To the Editor of the Scientific American:

Your issue of March 6 contains a letter from an English correspondent upon the subject of vaccination. Without going over the immaterial portions of his letter, those only of importance are, first, in relation to bovine and humanized lymph. Are they equivalent, and is vaccination performed with one considered equally protective by those who believe in vaccination as that performed with the other? He smites the air vigorously to establish what no one denies, namely, that they are equivalent and equally protective. Having gained this important vantage ground, he proceeds, in the second place, to show by statistics from various hospitals of Great Britain, that during ten years, irregularly and imperfectly observed, 37,636 cases of smallpox occurred, and that 28,468 of these were reported as vaccinated. This he brings forward as irrefragable proof that vaccination is an "unparalleled failure."

Now, this is the statement which in some form or other has been put forward as the strong argument against vaccination ever since agitation of the subject commenced.

Simply stated, it is this, that three-fourths of all the cases of smallpox treated in the hospitals of Great Britain have been vaccinated, consequently vaccination is valueless. Let us examine this statement, and in order to do so it is necessary first to determine what constitutes vaccination. In the January number of the *Popular Science Monthly* for the current year is an article entitled "Vaccination in New York." It is a statement of the methods and results of vaccination as practiced in this city, in contrast with the statements of Mr. Moncure D. Conway regarding the results, as he pictures them, in Europe, and especially in England.

I have there given the careful and exact methods of vaccination as practiced by the vaccinating corps of the Board of Health of New York, and a large class of intelligent practitioners of medicine, and the results obtained in the way of protection.

These results concisely stated are as follows: Vaccination, in order to be protective, should be done with eight-day lymph, either from a healthy infant or from the calf. The vesicle should be characteristically perfect on that day. The vaccination so performed should produce a similar perfect vesicle upon the eighth day and run its normal course.

Those who have given their attention almost exclusively to this subject for the past ten years, in connection with the Board of Health and in public institutions, recording cases and noting their behavior when subsequently exposed to smallpox, unhesitatingly declare their belief that such vaccinations are a perfect protection against the disease; at least to the same extent as though it had been experienced.

In support of this statement and belief numerous cases are cited, and the number could be *indefinitely increased* where, during the epidemic of 1874-5, among members of the same family, the unvaccinated, almost uniformly, when exposed, took the disease, while there is not a case of an individual who, having received the inspector's certificate of vaccination, subsequently contracted the disease, even though living for days in close rooms where it existed.

Another remarkable fact bearing upon this subject is the following, as reported by Dr. Taylor, Inspector of Vaccination. It was the custom, during the epidemic of 1874-5, where a mother having an infant at the breast was attacked by the disease, and was obliged to go to hospital, to immediately vaccinate the infant, and then send both mother and child to the smallpox hospital, a place at that time crowded with cases of the disease in every stage of progress. As a result of this procedure not a single infant so treated took the disease, notwithstanding the fact that the infant was nursed by the mother throughout her illness.

The belief of those who have been the most diligent students in this matter, is that one perfect vaccination protects through life; nevertheless a certain small percentage of those vaccinated in infancy only take the disease when exposed in later life. It is therefore advised that children vaccinated in infancy be revaccinated about the fifth or sixth year. So also as a safeguard against possible infection it is advisable that vaccination even in adults should be repeated, and especially at some time of unusual exposure, such, for instance, as must occur in epidemics of the disease.

It is not claimed that the rule of protection is absolute and without exception, any more than other rules and laws in the economy of nature. The fact of having once had smallpox is usually considered the best possible protection against future attacks; and yet cases occur where the disease is experienced twice and even more times by the same individual.

So persons who have been vaccinated according to the suggestions above laid down are considered thoroughly protected, though one case of smallpox in a very great number might possibly occur among them.

It is only persons who have been so vaccinated, and who have received all the protection which vaccination is capable of affording, who can properly be counted in arranging statistics upon this subject.

Now, what knowledge has your English correspondent concerning the 28,468 cases of smallpox which are reported as vaccinated? How many of these have ever *really* been vaccinated? How many of those really vaccinated have fulfilled the conditions necessary to thorough protection by the perfection of the virus used, a proper method of vacci-

nation, and, if necessary, revaccination? How many belong to the class which even smallpox itself does not protect from a second attack? Unless your correspondent is informed upon these points his statistics are useless. Yet it is just such loose statements and unreliable statistics as these that are constantly and invariably brought to bear as strong arguments against vaccination. They are specious, and perhaps calculated to deceive the multitude, but they betray that ignorance both of the subject and the proper use of statistics which certainly characterizes most of those writers and agitators who are at present directing their efforts against vaccination. R. OSGOOD MASON, M.D.

64 West 20th St., New York.

Dangers of Fire from Steam Pipes.

To the Editor of the Scientific American:

I would have replied ere this to Mr. Atkinson's letter, which appeared in your paper of February 21, were it not that I wished to complete some experiments on the ignition of wood and charcoal, the results of which I give you below; but before going further, it would be well to define the difference between seasoned wood, charred wood, and charcoal.

The first admits of no degree; it is simply wood with the sap and the excess of moisture, above what would be incidental to the hygrometric state of the atmosphere.

The second admits of degree, and is wood with the hydrocarbons partly driven off, according to the completeness of the charring.

The third admits of no degree, and is nearly pure carbon and ashes.

I inclosed a two inch cube of white pine wood within a small gas pipe retort, with a bit of solder (one-third tin and two-thirds lead) and a bit of sheet lead, and placed the retort in a boiler tube for five days, boiler going day and night. At the end of that time the wood was pure charcoal, the solder was melted, and the lead was not, which goes to show pure charcoal can be made at a temperature between 500° and 612° Fahr.

To prove the above was pure charcoal, *i. e.*, that all the hydrocarbon was driven off, I raised the temperature of the retort to about 1,200°, but could not drive off any more gas.

In October, 1877, I inclosed pine laths against the shell of a horizontal boiler, and covered them with a course of brick on edge. The pressure of steam in this boiler has been 40 to 60 lb. day and night since, except one day a month for cleaning. The ends of the laths that came out to the air and flush with the brickwork, are not near as dark as hemlock tanned leather, and the darkest part I could find which was entirely covered with brick is not as dark as roasted coffee. This goes to show charcoal cannot be made at 300° Fahr., after two and a half years, under the most favorable circumstances, with a furnace fire only five feet beneath it.

To prove this wood was not charcoal, I placed it in a retort and drove off gas that burned with nearly as much light as illuminating gas, when it leaves the retort.

In experiments on the ignition of charcoal, I found that the charcoal made in the boiler tube would not redden at the melting point of lead (612° Fahr), but would at a lower temperature than zinc (770° Fahr.).

My mode of operation was this way. I passed a gas pipe through a fire and blew pure air through the pipe. I also prepared myself with long slender strips of solder (half and half, and one-third tin and two-thirds lead), and with strips of lead and zinc, and pine shavings, and small pieces of the laths and charcoal.

The pure charcoal would not redden in the same blast that just melted the lead, but did in a blast which melted it rapidly. When held in a blast which melted solder (one-third tin and two-thirds lead, melting temperature about 500° Fahr.), it showed no signs of fire or redness.

The lath, which was two and a half years in contact with the boiler under a course of brick, would become charcoal in a temperature which melted half and half solder, but would not get a spark on it until I increased the temperature to where the needle of lead bent and dropped. The same with a nicely prepared splinter of white pine, in which I could see no deviation in the action from the splinter of the lath; they all became charred in the blast which melted half and half solder, but would not take on a spark until the lead melted.

With a blast that fused a metal 19 parts tin, 31 lead, and 50 bismuth, melting temperature about 212° Fahr., I could not turn tissue paper brown.

Gunpowder held in the blast which melted the lead did not explode until after the lead melted. It gave off a slight blue sulphurous light first, then the lead melted, and an instant after the powder exploded.

The statement I made in my first letter I now repeat, "that the temperature at which wood and charcoal fire is between 500° and 700° Fahr.," and that the purer the charcoal the higher the temperature required.

Illuminating gas will not take fire from a cherry red poker, but will from a bright red one.

The gas of wood, crude petroleum, soft coal, or any other hydrocarbon, will not take fire when escaping hot from the retort. With a cherry red poker I have tried the three mentioned.

I now wish to say that it was not my intention to make any of the readers of your journal careless in construction, and I would be sorry should my remarks, in answer to Mr. Smith's letter, be the cause of loss to any of them.

I know insurance companies act on the principle that "prevention is better than cure," and that the results in many cases justify their acts few will deny; but questions of fact must be answered yes or no, and not by the *modus vivendi* of the insurance agent.

I will comment on the points in Mr. Atkinson's letter as they occur, and will then try to show where the real danger lies in the use of boilers and steam pipes.

Is it not more likely that the wood of the "open boiling keir" was darkened in color by the oxide of iron from the nails than charred by the temperature of boiling water at atmospheric pressure, conducted through the length of the nails into the wood, and is not this *rusty* appearance often taken for charring?

The "fine charcoal" under some conditions might be classed with damp cotton, slack of soft coal, or lampblack; but while workmen are allowed to carry matches in their vest pockets, it would be safer to associate it with the matches, especially in the face of all the steam pipes that are packed in charcoal, and one in particular in California, where high pressure steam is carried 2,600 feet into a mine packed in charcoal.

The steam pipe "through the sill" prepared it for fire by drying it, and the dropping of a match, the fire from a cigar, or the superheating of the steam by getting low water in the boiler, could start it into active combustion. The same remarks will apply to the floor beam.

"Oiled waste cotton or wool and greasy overalls" have taken fire from being locked in a tool chest, *without* the aid of a steam pipe.

I will now endeavor to show why any one, whether insured or not, should comply with the requirements of the underwriters with regard to steam pipes and boilers, especially the latter.

When a journeyman, working in New York city, I was sent to John Hecker's house, in great haste, to see what the matter was with the steam heating apparatus. As soon as I entered the hall door I "smelled a burned boiler," and when I reached the boiler room I saw one. The generator was a sectional pipe boiler, and was red hot, with the pipes badly warped, and the fire still in the furnace. Upon investigation I found that the hair felt and canvas covering was charred through, the latter being as brown and crisp as burned leather for a distance of about fifteen feet, and beyond that, for about fifteen more, it showed signs of charring, lessening with the distance. It surprised me the house did not take fire, for, instead of having steam at a *maximum density* in the pipes, it was at first *superheated* (cause, very little water in the boiler), and as the pressure found vent through the burned boiler (as some of the tubes were burned through), it must have been red hot air or gas which filled the pipes, and nothing but the want of circulation prevented it from carrying the heat to the small uncovered pipes throughout the house.

This is not the only case that came under my notice. The First National Bank of Pittsburg had nearly the same experience when the janitor, in the fall of the year, fired two horizontal multitubular boilers for three hours (8 A.M. to 11 A.M.) before he discovered anything wrong. He then came to look for me, and did not find me until 1 P.M. The boilers were still hot, and the uncovered pipes near the boilers were turned blue black, the same as if they had just left the welding furnace and cooled; but where they were covered, the composition did not fall off, it being one of the lime and asbestos mixtures. Another case was a private house in Detroit, where the blow-off cock was opened maliciously, and the Chalmer-Spence covering was charred and destroyed, and had to be replaced on the boiler, and for about six feet beyond it on the main steam pipe.

I cite the above to show there is danger from superheated steampipes, and though the superheating of pipes is not an every day occurrence, it is safe to say they are more frequent than boiler explosions.

The following, though not generally recognized, often cause fires:

(1) The sudden closing of a damper on a fresh fire is apt to send flame or sparks through any cracks in the brickwork of a boiler.

(2) A *back draught*. The explosion of carbonic oxide, which sometimes takes place when any one opens the furnace door and admits air, where a lazy fireman has heaped coal on a dirty fire, which partly decomposes the coal by the heat of the fuel already in, but does not produce complete combustion for the want of sufficient air.

(3) The leaving of *banked fires* over night, with doors open or partly open, and dampers shut or partly shut, which, under some conditions, make small explosions of gas or throw hot coals by the bursting of slate in the fire out through the door.

The raking out the remnant of a wood fire at quitting time, which, though it be ever so well done, is attended with great danger from sparks.

The excessive heat from upright boilers, smoke pipes.

The taking fire of soot, of soft coal, or wood, which will never show itself, or never can assume active combustion, when the fire in the furnace is going, as the carbonic acid gas from one fire will not support a second in the smoke pipe; but should the first fire be low or out, the air will pass rich in oxygen to the second, and redden it, thereby heating the smoke pipe.

WM. J. BALDWIN.

ELMIRA, N. Y., March 13th, 1880.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR APRIL, 1880.

Mercury.

Mercury rises before the sun on April 1, but so near to the sun that it is not likely to be seen.

Mercury will be near Jupiter on the morning of the 8th, near Venus on the morning of the 15th, and will be at the greatest elongation west on the 26th. It rises at that time nearly an hour before the sun, and should be looked for about 12° south of the point of sunrise.

Venus.

Venus rises on April 1 at 4h. 51m. A.M. Venus will be near Mercury on the morning of the 15th, and near Jupiter eight hours later.

On April 30 Venus rises at 4h. 19m. A.M., nearly at the same hour at which Saturn rises, Venus being north of Saturn.

Mars.

Mars is the only planet visible to the eye which can be seen in the evening.

Its motions can be followed by connecting it with prominent stars in the constellations of Taurus and Gemini. On April 1 Mars rises at 9h. 15m. A.M., and sets 32m. after midnight. At meridian passage on April 1 Mars is 4° east of Beta Tauri, and 3° below the star in altitude. The crescent moon passes Mars on April 15.

On April 17 Mars will pass Mu Geminorum 2½° above the star. On the 23d Mars will pass Gamma Geminorum 8½° above the star. On April 26 Mars will have the same right ascension with Sirius, but will be more than 40° above Sirius.

On April 30 Mars rises at 8h. 36m. A.M., and sets at 11h. 48m. P.M.

Jupiter.

Jupiter ranges so nearly with the sun that it is not likely to be seen until the latter part of April, when it should be looked for before sunrise. Jupiter will be near Venus April 15. Jupiter rises on April 30 at 3h. 44m. A.M., almost exactly in the East.

Saturn.

Saturn rises so nearly with the sun that it is not likely to be seen during the early part of April.

Venus, Saturn, and Mercury rise nearly at the same time on April 30.

Uranus.

Uranus is in very good position for amateur astronomers, and is easily found with small telescopes. On April 1 it passes the meridian at 9h. 47m. P.M., at an altitude, in this latitude, of 58°. It has nearly the same right ascension as Rho Leonis all through the month; it is ⅛° above this star on April 1, and ½° above it on April 30.

A telescope of low power, which would give a large field of view, would bring the star and the planet into the field together.

Uranus may also be found 6½° east of Regulus, and 2° south of that bright star, early in the month.

39½ Messages an Hour.

The following are the best total records of the Western Union main office operations from February 1 to 15 inclusive:

DAY FORCE (PRINTERS).

Calvert	4,388	Noyes	3,377
Miller	3,396		

MORSE.

McLaren	3,795	Allen	3,293
Irving	3,698	Barberie	3,456
Harmon	3,644	P. J. Tierney	2,988
Brick	3,604	Hutchinson	2,979

NIGHT FORCE (MORSE).

Shain	4,078	Robinson	3,296
R. W. Martin	3,542	Case	3,177
Anson	3,374	Hinman	3,067
Sabine	3,313	Huston	3,300

The highest average was made by Printing Operator Calvert, which was 39½ messages per hour.

Leif Ericsson's Wild Oats.

Mr. Ernest Frölich, of Christiana, Norway, thinks he has found in our Indian rice a living proof of the truth of Snorre Sturlson's history of Leif Ericsson's visits to this country nearly nine hundred years ago. The voyagers reported finding in Vinland not only an abundance of wild grapes, but a kind of grain which they called wild oats, growing plentifully along the marshy river sides. This grain, which they said the natives used for food, can be no other he thinks, than the well known Indian rice, or wild rye (*Zizania*), which grows almost everywhere along the swampy borders of our coast streams as well as around inland lakes and ponds. Mr. Frölich proposes to follow the example of our Western game preserving associations, who are sowing wild rice in our marshes for the benefit of wild fowl, by sending home seed for planting on Norwegian marsh lands and moors.

Rapid Railway Building.

The greatest feat in the way of rapid railway making is said to be that of Sir R. Temple, in the late Afghan campaign. One hundred and thirty miles of railway was constructed in one hundred and one days.

ENGINEERING INVENTIONS.

Mr. John L. Cole, of Williamstown, Mass., has patented improvements in apparatus for checking the momentum of railroad cars and storing power to be subsequently used in starting or impelling the car, which apparatus consists, generally, of springs, a cord or chain, a conical spirally-grooved winding drum, and gearing and clutches for connecting the drum with the car wheels or axle, whereby the cord is wound on the drum, the springs compressed and held for use in propelling the car by their expansion.

An improvement in rail joints, patented by Mr. William W. Fay, of Jefferson City, Mo., consists in connecting the ends of adjoining rails together by means of a metal plate inserted in slots in the adjacent ends, and also in fastening and tightening the connecting plate in its place by means of laterally-driven dovetailed wedges.

Mr. Samuel L. Skinner, of Independence, Iowa, has patented a device for automatically restoring to their proper position the car wheels that may chance to run off the track while the cars are running. The invention consists of eccentric wheels with V-shaped grooves in their treads, adjusted on a car truck, and operated in such a manner that when the car wheels leave the rails the eccentric wheels will at once drop upon the rails and operate to raise the truck in line again, so that the car wheels will be restored to their proper position.

SCISSORS AND SCALE MEASURE.

This device consists essentially of a round rod or tube having a slot, within which is secured one blade of a pair of scissors, the other blade being held in the open position by means of a spring.

COMBINED SCISSORS AND SCALE.

In using this implement the operator grasps the rod in the right hand and inserts the fourth finger in the bow of the scissors. The goods to be cut are drawn over the rod with the left hand under the movable blade, when the scissors are closed, cutting the goods.

The inventor claims that this implement combines the usefulness of two instruments, while it offers no inconvenience in the use of either scissors or scale.

This improvement is the invention of Mr. Scott Stivers, of Liberty, Ind.

A Primitive Nation.

The new Mexican Inter-oceanic railway across the Tehuantepec Isthmus is marked out to pass through the State of Chiapas, which probably contains the only population in the world which possesses no iron, nor anything in the shape of an iron industry even of the crudest form. For the distance of eighty miles around Palenque, the capital, not a single blacksmith can be found, and the only articles in the shape of iron are axes and machetas, imported from the United States. Nails are unknown, all the woodwork being held together by cords or the tendrils of the vines, and even the tortilla is prepared by grinding the maize between stones. The new railway, which will run through this territory, has clearly a well defined educational as well as a commercial development to undertake.

Winter Fishing on Chautauqua Lake.

The winter fishing on Chautauqua Lake is a good deal of a business. Being an inland lake it freezes over quicker than Lake Erie, and when the latter body is open Chautauqua Lake has ice enough to hold up an army of fishermen. There are now about twenty "coops," as they are called, out on the ice. A "coop" is a box about three feet square, with a hole in the bottom. A hole is cut in the ice and the box is placed over it, and it being perfectly dark in there he can see the bottom as plain as day if the water is clear. If it is not clear, a newspaper is sunk to the bottom under the coop, and fish passing over it are easily seen. Through this hole in the ice a wooden fish properly weighted is sunk to the proper depth, and with a cord attached to it, the bogus fish is made to fly around lively, and thereby attract other fish to its locality. The man in the coop keeping watch, seeing a fish in good position, lets drop his heavy spear, weighing from fifteen to twenty pounds, fastening him to the bottom. Some large fish are caught in that way. The Monday before New Year's there were caught three pickerel weighing respectively twenty-seven, thirty, and forty-two pounds. It is quite a business when the pond is frozen over, and those who follow it make money.—*Silver Creek (N. Y.) Local.*

IMPROVEMENT IN JACKSCREWS.

The engraving represents a marked improvement in a simple yet most important mechanical appliance which is indispensable to those engaged in building or repairing houses, ships, engines, bridges, or railroads. It is known as Ball's patent jackscrew, and is manufactured by Mr. Albert Bridges, 46 Cortlandt street, New York city.

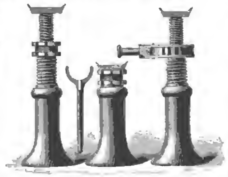


Fig. 1. Fig. 2.

BALL'S TELESCOPIC JACKSCREWS.

The screw, as will be seen by reference to the engraving, is double, the lower part being made tubular and threaded both externally and internally; one screw to the right and one to the left. The two screws operate simultaneously. The internal thread receives a solid screw carrying at the top a cap which is applied to the object to be raised.

The upper end of the tubular screw is provided with a head adapted to a wrench, as shown in Fig. 1, or it is provided with a ratchet head, as shown in Fig. 2. With this construction, when the tubular screw is turned, it not only raises the solid screw, but the latter being stationary, it is evident that it must be projected from the tubular screw at the same rate of speed as the latter is projected from the base, providing all of the threads are of the same lead.

It is stated that this jack will raise a load in one half the time required by the ordinary jack without an increase of labor. The screws may be run out nearly double the height of the base.

The stands vary in height from ten to twenty-five inches; the screw from fourteen to forty inches; the rise varies from eleven to thirty-six inches; and the total length ranges from twenty to sixty-one inches.

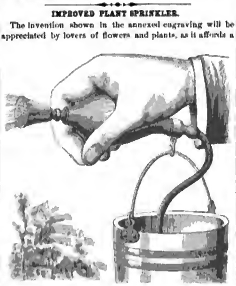
It is stated that there are 5,000 of these jackscrews in use.

Negatives on Paper.

M. Londe lately exhibited some negatives upon thin paper (*dioptrique*). It appears that this gentleman prepares a plate with talc and pours over it a collodio-bromide emulsion. When the negative has been obtained he floats over its surface a solution of gelatine and gum, and then lays the thin paper upon it, passes a squeegee over it to drive out excess of liquid, and allows it to dry. When thoroughly desiccated a sharp knife is passed round the picture about an eighth of an inch from the edge of the plate. The film is now lifted from the glass, and can be used on either side for printing purposes.

IMPROVED PLANT SPRINKLER.

The invention shown in the annexed engraving will be appreciated by lovers of flowers and plants, as it affords a



SCHRADER'S PLANT SPRINKLER.

convenient means of showering, and is not limited as to its supply of water. It consists simply of a rose sprinkler connected with a flexible bulb provided with a couple of valves and a suction tube. The pail containing the water may be of any convenient size. To operate the sprinkler it is only necessary to alternately compress the bulb and allow it to expand. When it is compressed it expels the water through the rose sprinkler. When it is allowed to expand it draws a fresh supply of water from the pail.

This invention was recently patented by Mr. August Schrader, of New York city.

Points about Welding.

The *Blacksmith and Wheelwright*, a journal that ought to know, says that to obtain a good sound weld, the following points should be observed:

The scarf should be sufficiently larger than the finished size to permit the weld to be well drawn out after welding. The joint surface of the scarf should be slightly rounding, so that, when the two pieces are placed together to weld, there will be no air inclosed between them.

They should be heated in a clear fire of bright and not gaseous coal. Thick pieces should not be heated too quickly, or the interior metal will not be brought up to the required temperature. They should be frequently turned in the fire, to insure uniformity of temperature, and be made as hot as possible without burning them.

They should be withdrawn from the fire occasionally, and sprinkled with sand, which serves to exclude the air from the surface and prevent oxidation, and at the same time cools the outer surface and thin edges, giving the interior metal and thicker parts time to become heated all through.

When the pieces are placed upon the anvil to weld them, they should be quickly cleaned with either a wire brush or a piece of wood made ragged by having been hammered. The scarfs should be placed to well overlap each other, and should receive light and quickly succeeding blows at first, and heavier ones afterward.

As soon as the pieces are firmly joined, the hammer blows should be delivered with a view to close the edges of the scarf, so that the joint of the weld shall not show where the job is finished.

IMPROVED PRUNING IMPLEMENT.

The principal object of the invention shown in the annexed engraving is to provide a guide for the pruning chisel, so that when the thrust is made to sever the limb the chisel will be properly guided so that the stroke will be effective. The invention consists of a long tine or finger attached to one of the edges of the chisel, and extending forward in the direction of the thrust of the chisel. The fixed end of this tine is bent outward, forming a hook, by means of which the limbs cut from the tree may be pulled out.

COGSWELL'S PRUNING IMPLEMENT.

This simple yet useful invention has been patented by Mr. John W. Cogswell, of Erie, Mich.

Pneumatic Clocks.

The Paris correspondent of the New York *Herald* has thought the following of sufficient importance to transmit by cable to New York:

Paris clocks have long afforded a subject of ridicule to foreigners. In a few days there will be no room for derision. Within the last week handsome public, illuminated timepieces have been erected in the middle of the causeway of the leading thoroughfares. These are all in communication with the works of the new Pneumatic Clock Company, in the Rue St. Anne. By means of subterranean tubes this company receives the time direct from the Observatoire every morning, and regulates all the timepieces in connection simultaneously. In future it will be possible to have the correct time laid on in any house, like gas or water, at the trifling cost of from three to five centimes per clock per day. I was allowed to inspect the company's premises privately to day, and examined the whole arrangements. The air is compressed by steam engines and driven at intervals of a minute through the communicating tubes, so as to move the minute hands the requisite distance at each pulsation. It can be applied to any clock. The company undertakes to pay all the cost of the fittings. It supplies clocks gratuitously and charges only a subscription. By this new system all trouble of repairing and winding up is done away with. Over one thousand pneumatic clocks are ordered in Paris already, and will soon be tested at New York, where the patent for America has been purchased.

Another New Jersey Fossil Sea Serpent.

The jaws and a portion of the vertebræ of a fossil sea serpent (*Python-morpha*) were found not long since in a marl pit at Marlborough, New Jersey. Professor Lockwood estimated the length of the living serpent to have been from 40 to 60 feet—considerably less than that of a previously discovered specimen. Tooth marks on the bones indicate a grand feast of ancient fishes when the dead monster "lay like a great wreck on the old ocean bed." The teeth, though formidable, are about half the size of those of the 80 foot specimen previously discovered.

NEW LUBRICATOR FOR STEAM ENGINES.

We give, on this page, two views of a novel engine lubricator, recently patented by Mr. A. L. Harrison, chief engineer of U. S. revenue cutter Samuel Dexter, Newport, R. I., one view showing the exterior in perspective, the other being a vertical central section.

This lubricator is designed to effect a regular and continuous lubrication of the cylinders and valves of the engine to which it is applied. The lubricant is supplied in regulated quantities, forced in against the steam pressure by atmospheric pressure obtained by the use of a vacuum chamber or by the use of a water column.

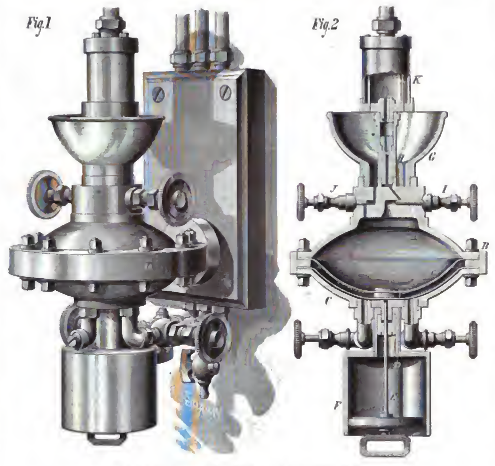
The oil and pressure chamber, A, is formed of two concave disks bolted together on a flanged ring, B, clamping the flexible diaphragms, C, leaving a small space between them. A single diaphragm might be used, but two are preferred, with the space between them filled with glycerine or other non-freezing liquid, forming a flexible partition between the diaphragms, which prevents unequal stretching and equalizes the pressure. This space is filled through openings in the ring, B, which are closed by screw plugs.

At the under side of the chamber, A, there is a tube, D, through which passes a rod, E, whose inner end is rigidly connected to the center of the diaphragms, C, by means of clamping washers. To the lower end of this rod is secured a handle by which the rod may be moved to draw the diaphragms to the bottom of the chamber, A. This rod also carries a piston fitted to the cylinder, F, on the lower end of the tube, D.

At the upper side of the chamber, A, there is an oil cup, G, used in filling the lubricator and tube, H, for the discharge of oil from the chamber, A. The cup, G, and tube, H, communicate with the chamber, A, by separate passages fitted with cocks, J and I, respectively.

On the upper end of the tube, H, there is a chamber, K, the sides of which are made of glass. In the bottom of this chamber there is a small opening communicating with the tube, H, and on the top there is an opening provided with a tube leading to the parts to be lubricated. The chamber, K, is to be filled with glycerine.

To the under side of the chamber, A, two pipes are connected, having communication separately with the space beneath the diaphragms, and are each fitted with a cock.



HARRISON'S LUBRICATOR FOR STEAM ENGINES.

One pipe is to be connected with the exhaust of the engine when the lubricator is used in connection with condensing engines, and the other pipe is to be connected with the steam pipe from the boiler. This connection permits of the attachment of the lubricator to the engine or to a wall, as may be desired.

The lubricator is provided with a second exhaust pipe that opens into the tube, D, and cylinder, F, and is fitted with a pipe for connection with the exhaust of the engine. This pipe has a two-way cock for closing connection between the cylinder, F, and engine exhaust, and opening connection between the cylinder and the outer air or the reverse, as may be required.

To charge the reservoir, A, with oil, the oil is first poured into the cup, G, and the cock, J, is opened to allow the oil to enter the reservoir, and one of the cocks below the reservoir is also opened so that the space below the diaphragm may be exhausted by the pipe connected with the exhaust of the engine. The diaphragm is thus drawn down and the oil drawn into the reservoir. The cylinder, F, will at the same time be opened to the outer air.

The reservoir, A, being thus filled, the cocks, J and I, are closed, and the exhaust pipe is put into communication with the cylinder, F, and steam is admitted below the diaphragms. The diaphragms are thus balanced by steam pressure, and the cylinder, F, being exhausted, its piston is forced inward by atmospheric pressure, carrying the rod, E, and diaphragm, C, upward, forcing oil through the pipe, H, into the glycerine chamber, K, in drops at more or less frequent intervals or in a continuous stream as circumstances may require, the flow being regulated by the valve, I. From the glycerine chamber, K, the oil flows through the tube to the engine cylinder. This lubricator, when applied to high pressure engines, is operated by the gravity of a water column instead of atmospheric pressure. This device, although apparently complicated, is really very simple and well calculated to fulfill the requirements of a first class lubricator.

For further particulars, address the inventor, as above.

The Great Glaciers of Alaska.

The Stickine is perhaps better known than any other river in Alaska, because of its being the way back to the Cassiar gold mines. It is about 350 or 400 miles long, and navigable for small steamers to Glenora, 150 miles, flowing first in a general westerly direction through grassy, undulating plains, darkened here and there with patches of evergreens, then curving southward, and receiving numerous tributaries from the north, it enters the Coast Range and sweeps across it to the sea through a Yosemite Valley more than 100 miles long, and 1 to 3 miles wide at the bottom, and from 5,000 to 8,000 feet deep, marvelously beautiful and inspiring from end to end. To the appreciative tourist sailing up the river through the midst of it all, the cañon for a distance of about 110 miles is a gallery of sublime pictures, an unbroken series of majestic mountains, glaciers, falls, cascades, forests, groves, flowery garden spots, grassy meadows in endless variety of form and composition—furniture enough for a dozen Yosemites—while back of the walls, and thousands of feet above them, innumerable peaks and spires and domes of ice and snow tower grandly into the sky.

About 15 miles above the mouth of the river you come to the first of the great glaciers, pouring down through the forests in a shattered ice cascade nearly to the level of the river. Here the cañon is about two miles wide, planted with cottonwoods along the banks of the river, and spruce and fir and patches of wild rose and raspberry extend back to the grand Yosemite walls. Twelve miles above this point a noble view is opened along the Skoot river cañon—a group of glacier-laden Alps from 10,000 to 12,000 feet high, the source of the largest tributary of the Stickine.

Thirty-five miles above the mouth of the river, the most striking object of all comes in sight. This is the lower expanded portion of the great glacier, measuring about six miles around the snout, pushed boldly forward into the middle of the valley among the trees, while its sources are mostly hidden. It takes its rise in the heart of the range, some thirty or forty miles away. Compared with this the Swiss *mer de glace* is a small thing. It is called the "Ice Mountain," and seems to have been regarded as a motionless mass, created on the spot, like the rocks and trees about, without venturing a guess as to how or when. The front of the snout is about 300 feet high, but rises rapidly back for a few miles to a height of about 1,000 feet. Seen through gaps in the trees growing on one of its terminal moraines, as one sails slowly along against the current, the marvelous beauty of the chasms and clustered pinnacles shows to fine advantage in the sunshine; but tame indeed must be the observer who is satisfied with so cheap a view.—*San Francisco Bulletin.*

MISCELLANEOUS INVENTIONS.

Mr. James T. Cochran, of Brooklyn, N. Y., has patented a horseshoe designed to prevent the horse from interfering, slipping, or injuring the hoofs in any way. It will allow the hoofs to expand properly, and is so arranged as to avoid contact with the sensitive part of the sole. The shoe is provided with a toe calk having a smooth unbroken beveled surface on the inside, a straight surface on the outside, and separated from the side calks by V-shaped notches.

Mr. James H. Hayes, of Cerro Gordo, Ill., has patented an improved nut lock, which is simple, convenient, and effective. It consists in a nut lock formed of U-shaped springs, which is provided with small lugs at the forward ends, and is designed to prevent two or more nuts from turning.

An improved recording ballot box has been patented by Mr. James G. H. Buck, of Dallas, Texas. The object of this invention is to indicate accurately and instantly the result of an election; to prevent the possibility of rifling the box of its ballots, or of stuffing it with fraudulent ones.

An improved sled, which is so arranged that it can be propelled and regulated in speed and direction by the person seated on it, has been patented by Messrs. Alfred Hitchiner and John W. Heaton, of Lawrence, Mass. The invention consists in a sled provided with a standard to which two slotted bars having hooks at the lower ends are pivoted, these bars being grasped by the person on the sled, and used to propel it and to press against the brakes, which are pivoted to the end of each side of the sled.

Mr. John A. Musselman, of Steinsburg, Pa., has patented an improved cooking stove. The object of this invention is to combine with a cooking stove an auxiliary heating stove, so arranged that it can be used either separately from the cooking stove or in connection therewith, as may be desired.

An improvement in lamps has been patented by Mr. Frank R. Kimball, of Boston, Mass. The object of this invention is to prevent any flow of oil to the burner except in the form of vapor, and to supply the oil automatically to the vaporizer in quantities as required; also, to construct the oil reservoir in a form adapted for ready application to or removal from an ordinary street lamp.

Mr. John Wampach, of Shakopee, Minn., has patented an improved fifth wheel. The object of this invention is to improve vehicles so that their wheels may pass over uneven surfaces without wrenching or twisting the gearing.

An improvement in water heaters, patented by Mr. William R. Hinsdale, of Garden City, N. Y., relates to apparatus for heating water by steam while circulating through pipes, as in dwelling houses, directly to the wash basins, bath tubs, laundry tubs, or other places of use, or to hot water heating apparatus in dwelling houses, stores, or buildings, such apparatus being particularly adapted for use where cities or towns are supplied with steam for heating and other purposes through street mains and a water supply under pressure.

Fatal Effects of Fog.

A single week of raw and densely foggy weather more than doubled the death rate of London, compared with the average for the corresponding week for the preceding years. The weekly reports of the Registrar-General show that the annual death rate had risen steadily during the three weeks preceding the foggy period from 24·6 per thousand to 27·1 and 31·3; then it bounded to 48·1, a rate higher than had been recorded since the cholera epidemics of 1849, 1854, and 1866. While the increase in deaths in the West End districts of the metropolis did not exceed 32 per cent, in the crowded quarters at the East End it was equal to 83 per cent. The largest number occurred among people past sixty years.

A Mountain takes the Place of a Lake.

Interesting particulars begin to come in with regard to the effects of the series of earthquakes experienced in San Salvador toward the close of last year. The severest shocks were felt in the neighborhood of Lake Ilopango, which has always been regarded of volcanic origin.

On December 21 the earthquake movements were particularly marked, and accompanied by a horrible rumbling sound beneath the earth, which, more than its tremblings and oscillations, spread terror through the already alarmed population. That night no fewer than 150 distinct shocks were felt, and the people abandoned their houses in dismay. During the succeeding days of the month the movements continued, and on the night of the 31st a tremendous subterranean detonation was heard, like the discharge of heavy cannon, succeeded by three successive shocks of great violence, which were felt throughout the entire republic, and, in the immediate theater of their action finished the ruin their predecessors had begun. In the vicinity of the lake a rainstorm followed, of such violence as has not been experienced for years, the rush of waters carrying to the lake vegetation, soil, trees, and everything in their way, making huge gullies, rendering useless some valuable lands on the margin of the lake. The waters of the lake, instead of appearing to be increased by this large addition to their volume, actually diminished.

As the water retired conical-shaped peaks or hills appeared in the center of the lake, while the water surrounding them was in a state of commotion as though it were boiling, and on examination it was found that its temperature had materially increased. From the highest of these peaks, which are constantly increasing in size, smoke, vapor, and flame issued, the column rising as high as that which issues from the Izalco, and may be seen from the capital, a distance of several leagues. The central hill of the group thus forming appears to be increasing in size more rapidly than the others, people in the neighborhood estimating its growth as prodigious. The water of the lake has gradually resumed its level and raised in height as the process of formation of the volcano continued, escaping through its outlet at an immense rate. It is thought that it will soon be emptied into the sea and the mountain will take its place.

The volcano keeps regularly at work, occasionally sending up showers of stones, which, falling on its sides, add to its dimensions. Since it has begun its functions in such a marvelous manner the shocks of earthquake have ceased, although at intervals the subterranean noises are heard, but only in the immediate neighborhood of the burning mountain. The vapors which issue from it are heavily charged with sulphurous materials, which produce a nausea, and in many cases have induced sickness, mostly fevers. With the beginning of the volcanic activity springs broke out in various places, some of potable water, and others horribly fetid and disgusting. Mr. Goodyear, State Geologist, will probably soon issue a report upon the remarkable phenomena involved.

VENUS' GIRDLE.

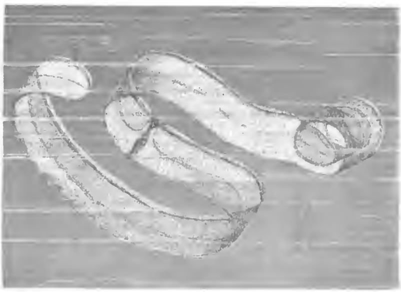
This pretty creature is found in the Mediterranean, where it attains the extraordinary length of five feet, the breadth being only two inches. The mouth of the Venus girdle is in the center of the body, occupying a comparatively small space. The body is ribbon-shaped toward two opposite sides from the mouth. The edges of the ribbon-like body are serrated or provided with numerous little lips, by means of which the creature propels itself forward. It can also propel itself from one place to another by a peculiar spiral movement.

The Venus' Girdle, with its magnificent colors, is a most beautiful object. Various attempts have been made to keep them in aquariums, but they survive for a few days only. They are attacked by the other animals in the aquarium, and have such a ravenous appetite that it is almost impossible to supply them with sufficient food. When touched they immediately roll themselves up into a regular spiral.

Owing to its great length and tenuity the Venus' Girdle is seldom found quite entire, but it seems to care little for a foot or so of its substance.

The Spirilla-Spirochætes.

It has been pretty conclusively proved by Obermeier that relapsing fever is due to the entrance into the blood of this minute air-born vegetable organism. In further proof of this, we are informed by the London *Medical Record*, January 15, 1880, that Vandyke Carter, in India, has injected under the skin of monkeys defibrinated blood proceeding from patients suffering from relapsing fever, and which contained spirillæ. On the sixth day the monkeys were attacked with violent fever, and the blood was filled with spirillæ. Cohn, of Breslau, has further cultivated this spirilla in successful culture fluids outside of the body, and reproduced feverish attacks with the third or fourth culture fluid.

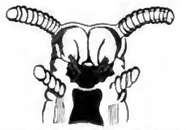


VENUS' GIRDLE.—(*Cestum Veneris.*)

PERIPATUS CAPENSIS.

In his interesting "Challenger Notes," writing from the Cape of Good Hope, Mr. H. N. Moseley says:

I stayed at Wynberg for a fortnight, while working at the anatomy and development of *Peripatus capensis*. Peripatus is an animal of the very highest importance and antiquity, and I believe it to be a nearly related representative of the ancestor of all air-breathing arthropoda, *i. e.*, of all insects, spiders, and myriapods.



HEAD OF PERIPATUS CAPENSIS MAGNIFIED.

The animal has the appearance of a black caterpillar, the largest specimens being more that three inches in length, but the majority smaller. A pair of simple horn-like antennæ project from the head, which is provided with a single pair of small simple eyes. Beneath the head is the mouth, provided with tumid lips and within with a double pair of horny jaws.

The animal has seventeen pairs of short conical feet, provided each with a pair of hooked claws. The skin of the animal is soft and flexible, and not provided with any chitinous rings. The animal breathes air by means of tracheal tubes like those of insects. These, instead of opening to the exterior by a small number of apertures (stigmata) arranged at the sides of the body in a regular manner, as in all other animals provided with tracheæ, are much less highly specialized. The openings of the short tracheæ are scattered irregularly over the whole surface of the animal's skin.

PERIPATUS CAPENSIS. (Natural Size.)

It appears probable that we have existing in peripatus almost the earliest stage in the evolution of tracheæ, and that these air tubes were developed in the first tracheate animal out of skin glands scattered all over the body. In higher tracheate animals the tracheal openings have become restricted to certain definite positions by the action of natural selection.

The sexes are distinct in *Peripatus*. The males are much smaller and fewer in numbers than the females. The females are viviparous, and the process of development of the young shows that the horny jaws of the animal are the slightly modified claws of a pair of limbs turned inwards over the mouth as development proceeds; in fact, "foot-jaws," as in other arthropods

Before I studied *Peripatus* at the Cape nothing was known of its manner of development, nor of the fact that it breathed air by means of tracheæ. It was generally placed with the annelids, though its alliance with the myriapods had been suspected by Quatrefages.

That *Peripatus* is a very ancient form is proved by its wide and peculiar distribution. Species of the genus occur at the Cape of Good Hope, in Australia, in New Zealand, in Chili, in the Isthmus of Panama and its neighborhood, and in the West Indies. If its horny jaws were only larger they would no doubt be found fossil in strata as old as the Old Red Sandstone at least.

The animal is provided with large glands, which secrete a clear viscid fluid, which it has the power of ejecting from two papillæ, placed one on either side of the mouth. When the animal is touched or irritated it discharges this fluid with great force and rapidity in fine thread-like jets. These jets form a sort of network in front of the animal, which looks like a spider's web with the dew upon it, and appears as if by magic, so instantaneously is it emitted. The viscid substance, which is not irritant when placed on the tongue, is excessively tenacious, like bird-lime, and when I put some on a slip of glass some flies approaching it were at once caught and held fast. It appears from the observations of Captain Hutton on the New Zealand species,* that the jet of slime is used by the animal not only as a means of offense but to catch insects, on which the animal feeds.

I found only vegetable matter in the stomachs of the Cape species, and concluded that the animals were vegetable feeders. The animals live at the Cape in or under dead wood, and I found nearly all my specimens at Wynberg in Mr. Maynard's garden in decayed fallen willow logs, which were in the condition of touchwood. I tore the logs to pieces and found the animals curled up inside.

The animals are very local, and not by any means abundant, so that an offer of half a crown for a specimen to boys did not produce a single example.

My colleague, the late Von Willemoes Suhm, and I both searched hard for *Peripatus*. He was unsuccessful; but I was lucky enough to find a fine specimen first, under an old cart wheel at Wynberg. Immediately that I opened this one I saw its tracheæ and the fully-formed young within it. Had my colleague lighted on the specimen he would, no doubt, have made the discovery instead.

Peripatus capensis is nocturnal in its habits. Its gait is exactly like that of a caterpillar—the feet moving in pairs and the body being entirely supported upon them. The animals can move with considerable rapidity. They have a remarkable power of extension of the body, and when walking stretch to nearly twice the length they have when at rest.

Had I not been engaged for so long a time in working at *Peripatus* I should have certainly paid a visit to the Knysna Forest, accessible by steamer from Cape Town, which contains wild elephants preserved by Government, and numerous antelopes, and other large animals.

[For a detailed account of the anatomy and development of *Peripatus capensis*, see H. N. Moseley, "On Anatomy and Development of *Peripatus Capensis*," Phil. Trans. R. Soc., 1874, p. 757. The engravings and description here given are from the "Challenger Notes."]

How a Botanic Garden is Formed in Japan.

The following extract from a report from Hakodate, Southern Yesso, says the *Gardener's Chronicle*, will indicate the aptness of these intelligent people, the Japanese, to seize a new idea from a foreigner:

"An inkling was given to three of the principal native storekeepers by a lady to start a botanical garden. The idea was jumped at, as this was the very thing they had always desired to have, the Japanese being so very fond of flowers, and more especially foreign flowers; but the individuals in question, who are brothers, did not know how to set about it, and what seeds to order, and when they had them, what to do with them. Accordingly a plan for a garden was drawn up, and some one having an idea of gardening was engaged, after which a spot of ground was selected most suitable for a flower garden; but when application was made for it the Kaitakushi took the matter in hand, and has now started a public garden, the foreign directress still being consulted on all matters. In order to give it the character of a public undertaking, every ward of the town was induced, in succession, to work there one whole day, besides the regular coolies paid by the Kaitakushi. When the whole town had thus contributed its quota of labor, all the singing girls of the tea houses, with the other inmates of these establishments, dressed up in gay colors, were engaged there one whole day in smoothing down the paths with a stone fastened to ropes handled by about a dozen girls each, singing and dancing all the time; and, to crown all, one Sunday all the officials, from the highest to the lowest, dressed in laborers' working clothes, were engaged in finishing the '*fusiyama*' of the garden, without which no Japanese garden is complete."

* Captain F. W. Hutton, "On Peripatus Novæ Zealandiæ. Ann." and Mag. Nat. Hist., 1876, p. 361.

SPECTERS IN THE AIR.

BY CHAS. B. BOYLE

Had the causes of the mirage been understood, life and property might often have been saved, and, as utilizing that knowledge is one of the objects of this paper, it may be well to consider the subject in chronological order.

The accompanying diagram is given by Sir David Brewster as the geometrical exponent of fits of extraordinary atmospheric refraction, to which he attributes the phenomenon of the mirage, by which he means that the earth's atmosphere is subject to *fits of refraction*, so extraordinary that objects on the surface of the earth may appear at times elevated above it at angles as great as thirty or forty degrees. If the earth's atmosphere is subject to such excessive changes in its refractive energy, how happens it that the sun, moon, or stars never appear displaced by it, even when seen over the horizon where the greatest amount of displacement by refraction occurs, and where they are never affected by refraction beyond a single degree?

In astronomical observation no greater amount of refraction is ever obtained at the horizon than one degree, and as the angle of observation above the horizon increases, the atmospheric refraction decreases, till at the zenith it is nothing. The varying amount of atmospheric refraction at the horizon, where it is greatest, is never more than five minutes of a degree, and the only visible sign it gives is the slight enlargement of the apparent size of the sun or moon, and their appearance and that of stars above the horizon a few seconds in advance of their true time. If, when examples of the mirage are occurring, we direct a telescope along the line of the mirages, we shall find that our instrument is seeing in straight lines, which would not be the case if the line of vision were passing through an atmosphere of varying density. While engaged in locating a lighthouse at sea and sighting an object on a distant mountain side, the line of vision frequently passed over vessels and under their images in the air, and, therefore, through the section of atmosphere which Sir David's theory assures us was then undergoing a fit of *extraordinary refraction*, but in no case did the reading of the angles vary in the slightest degree from those obtained at other times. Indeed, if the earth's atmosphere were subject to fits of extraordinary refraction, the sciences of engineering, navigation, and astronomy could have no existence, for then neither the telescope nor the naked eye could see in straight lines, and, consequently, triangulation of any kind would be practically impossible beyond the limits of a straight edge. A navigator might find his true place upon the ocean to-night by measuring the angular position of a star under normal conditions of atmospheric refraction; to-morrow night another navigator might be in the same spot and undertake to find his place upon the ocean by measuring the angular position of the same star, but might find it varying from one to forty degrees from what it read upon the previous night, if the medium through which it had to be observed were subject to fits of *extraordinary refraction*, and, as it would be impossible to determine at any given moment the amount or direction of the displacement, finding latitude and longitude by the stars would be impossible, and, if attempted, would be certain to lead to disaster; whereas, all navigators place the most implicit confidence in those celestial observations, which they could not do if the atmosphere were subject to fits of *extraordinary refraction*, nor would it be possible to map any portion of the earth's surface.

Imagine an engineer triangulating for the purpose of mapping a coast line, without the means of knowing when his telescope was seeing in straight lines or when it was not, and never being able from moment to moment to determine how much or how little its line of vision was deflected from the line of its axis, if at all. Determining the trend of a coast in a world where such conditions existed would be simply impossible. The same is true of surveying lines of railroads, canals, and all kinds of engineering, where long sights are a necessity.

The region through which the Suez Canal has been built, is one where the phenomenon of the mirage is of most frequent occurrence, but the engineers have in no instance experienced trouble by having their lines of vision deflected from the axis of their telescopes. Why, if the earth's atmosphere were subject to fits of extraordinary refraction, a map of the heavens could not be made, as no observer could tell when a star was displaced or the amount or direction of the displacement; even marksmanship could not exist, as a hunter might be firing at the image of a deer which was, in fact, behind an adjacent hill many degrees away from the line of the shot. Firearms to shoot round corners would then be in order.

If, from the facts observed, we measure the position of the ship and that of its image in the air, we shall find the quantity of refraction too great to be obtained, even by a medium varying in density from atmosphere to glass; so slight, in fact, is the variation in the density of the earth's atmospheric conditions that we require the most delicate instrument to measure it, and the most extreme amount indicated by the mercury is never sufficient to perceptibly deflect a ray of light passing through it; no barometrical observations have ever recorded at any place or at any time any change in atmospheric density that would warrant the theory of extraordinary fits of refraction.

Now, let us observe what takes place while we try some experiments which we can bring under our immediate control. Lay an ordinary sized mirror, say twenty-four inches long, down upon a table with the mirror side up, setting on

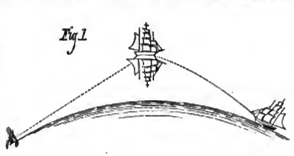


Fig. 1

the glass, at about its middle, a toy ship or boat with sails, made of paper, if we please. Let the bottom of the boat's hull be flat, so that it will stand in upright position and crosswise on the glass, "athwart ships" of the mirror, then hold a light above and beyond one end of the mirror, as shown in diagram 2, the light from which, after falling upon the mirror, is reflected in the direction A, where, being intercepted by a screen, it presents two images of the ship, one right side up and one wrong side up, with their bottoms

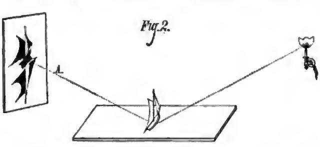


Fig. 2.

apparently together. If we remove the mirror and put in its place a dish of water with the ship afloat in it, the result will still be the same, with the exception that the images will be less distinct, owing to the fact that the surface of the water reflects less light than that of the mirror, but if we increase the brilliancy of the flame, the distinctness of the images at A will increase in proportion, and when the instrument be placed in the sunlight they remain quite distinct, even when projected upon thin gauze and when the distance from the

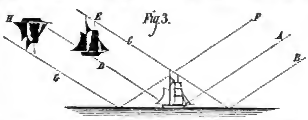


Fig. 3.

ship is much increased. We have, then, in this experiment the sun, the ship, the water, and the peculiar combination of images in the air, which constitute the most remarkable examples of the mirage in nature.

The results are identical; there can only remain a question as to the identity of the causes. That the images seen in the air become visible by being projected upon intercepting clouds there can be no doubt, because it is not possible to make images projected in air visible unless by their interception. Just as the pictures projected by a magic

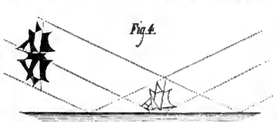


Fig. 4.

lantern are everywhere in the air between the screen and the camera, yet are visible nowhere but on the screen, so the images of the ship are everywhere present in the air between the ship and the image, but remain invisible till their interception by a screen, as may be proved by holding the screen in the experiment at any distance from the toy ship along the line of the reflected images, where it may everywhere be shown, but nowhere in empty space. And as nature has no other screens in air but clouds, they must be the backgrounds which, by intercepting those images, make them visible. This, however, has been put beyond a doubt by a case witnessed in this city, where a number of people saw the image of a burning brig, which was six or seven miles distant, distinctly visible on the smoke of some asphaltum, which had accidentally caught fire in the street where they were.

In every case where the time of day is mentioned with the observation of the phenomenon, we find that it occurred when the sun was low; thus the observation made by Mr. Gresham took place about four o'clock in the afternoon; we also find that it is much more frequent in the Arctic seas than elsewhere, because there the sun is always low, while in the lower latitudes it is low only in the early and later portion of the day. The causes of its more frequent occurrence when the sun is low is due to the fact that the reflected image makes a correspondingly low angle with the surface of the water, and is therefore much more likely to be intercepted by clouds before making its exit from among them into space, than if it were reflected from the surface at angles nearer to the perpendicular, in which case it would stand but little chance of interception by those wandering backgrounds. Indeed, it is impossible for the sun to shine upon moderately still water without reflecting back to heaven images of all things resting on its surface or about its edges with sufficient elevation above it to cast shadows upon its surface. It is only upon exceptional occasions that any of those images are intercepted by a cloud screen, and when that happens we call it a mirage, specters in the air, etc. When but a single image of a ship at sea is seen in the air, it is due to the fact that the intercepting cloud screen is in position to receive but one of its shadows, for both are projected from the ship in every such case. If the right side up image is visible without the other, then the cloud is too high to intercept the lower one, and if the wrong side up or inverted image is exhibited without the other, then the cloud is too low to intercept the upper image, as may be seen by the third diagram, where A B is a sheaf of sun rays falling upon the water on the sunward side of the ship and reflected back into space along the line, C D, carrying with it a shadow of the ship right side up, which, being intercepted by a cloud at E, becomes visible there. The lines, A F, bound another sheaf of rays, which project a shadow of the ship on the water beyond it, which being reflected into space along the lines, D G, and intercepted by a cloud at H, becomes visible there, thus accounting for the phenomenon of an erect image of a ship presenting itself in one part of the heavens and an inverted image of the same ship in another part at the same time; this, however, is so rare a combination of cloud, ship, and sun that is very seldom witnessed, and when it is, it most usually happens that only fragments of both images are seen, because the accidental passing of the clouds is more likely to bring them but partially into the paths of the shadows. More frequently it happens that one image, or one image with a fragment of the other, makes its appearance, because of the accidental distribution of the cloud screens which intercept them; but when this background is sufficiently large and posed in the path of both shadows, then both images appear in the same place, as shown in the fourth diagram. Even an almost imperceptible mist will serve to make those images visible, as may be shown by placing in the path of the artificially produced image a thin gauze, which will show the air phantoms, when received, from either side. The double image, however, is a phase of the phenomenon which can only occur when the object from which it is projected is surrounded by the reflecting surface, hence its occurrence most frequently at sea; it may occur on land, however, when the object is surrounded by plains turned into reflecting surfaces by recent rain, where numerous little pools, wet vegetation, etc., become the equivalent of a mirror, more or less broken, it is true, but as all the pools, however great or small, assume one common horizontal surface, they are the equivalent of a fractured mirror, which acts in the case precisely as if it were not broken when the reflection takes place from the upper surface. An example of this kind was witnessed at Petersburg, Va., where the image of a church standing near was seen in the air; fortunately, the observer incidentally remarked, without seeming to suspect that it had any connection with the production of the phenomena, that the time was about four o'clock in the afternoon and that a thunderstorm had just passed over. The observation made in this city supplies the rest, for the exhibition began with the breaking out of the sun from behind a cloud and ended with the existence of the column of smoke that supplied the background.

When an object is located on the shores of the reflecting surface only a single image of it can appear in the air, and this will be right side up, if the sun is on the water side of the object, or inverted, if the source of light is on the landward side, because when the shadow of the object is cast upon the water before reflection takes place, the reflected image is always bottom up, but when the light is reflected from the water before encountering the object, the shadow projected is always erect, as may be seen by the fifth dia-

gram, where the sun is assumed to be on the left hand side, where also is the obelisk, A, the shadow of which is cast upon the water at B, and thence reflected to the cloud, C, where it appears inverted. The obelisk, D, is on the opposite side of the water, therefore the sunlight falls upon the surface at E, and is reflected upward before encountering it; but when it does encounter it, the obelisk cuts its form out of the light, which shadow proceeds onward and upward with the reflected light, until it is arrested by the cloud, F, where it is made visible right side up.

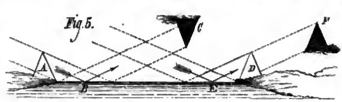


Fig. 5.

This last example of the air pictures was beautifully shown in a case observed on the south coast of England. A windmill stood upon a promontory with an eastward shore. The sun was rising, and an erect image of the windmill was seen in the air to the westward, obviously projected upon the morning mist. As the sun ascended so did the image, because the angle of reflection being equal to the angle of incidence, it must ascend from the reflecting surface at the same angle at which the sun shone down upon it, or that at which its light was incident upon it, but in proportion as it ascended it became less distinctly defined, and finally disappeared by gradually fading away, because the morning mist increased in attenuation in proportion as its altitude increased above the water. The image also moved northward at the same rate that the sun moved southward, in this also obeying the law of reflection; for the sun, the mill, and the image must, of necessity, occupy a perpendicular plane common to them all. As the mill was stationary and the sun in motion about it, all shadows of the mill cast by the sun must, of course, move about it in the opposite direction to that in which the sun was moving, precisely as if the sunlight and the shadow were opposite and connected radiates of the mill, just as when the sun is in the east it casts its shadows to the west, and as it moves westward it casts them more eastward, pointing east when the sun is due west, and west when the sun is due east, or always opposite the sun. All aerial images produced by this phase of the mirage are shadows *only* of the objects they represent, and, like all shadows, present only outline forms. They are frequently observed inland, and, if their causes were understood, might at times serve very valuable purposes.

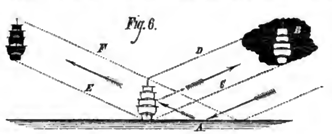


Fig. 6.

Recalling the case of a party of trappers with laden animals crossing some of our Western wastes and perishing for want of water, yet seeing in the air the image of an eagle, right side up, perching upon the branch of a dead tree, and superstitiously regarding it as an ill omen, instead of comprehending that it was a messenger sent by the sun to say that if they turned their faces toward him he would lead them to water in a very short time, yet still toiling past, unwittingly rejecting the proffered relief, is one of the melancholy prices we often pay for the luxury of ignorance or of false interpretation of natural phenomena. The real eagle was seated on the branch of a dead tree which stood on the nearest edge of a sheet of water not, probably, half an hour's journey from them, for images projected by small objects cannot be visible far from their original source, for, like all shadows, they consist of the actual and penumbral shadow, the latter fading away with the distance and the former growing smaller. As even the branch of the tree was shown in this case, the probability is that the water was not more than a mile away, yet they toiled on past it to many a death of horse and man. The sun not only projects double shadows of all objects upon water, lying in the path of its rays, away from it, but also forms in air real pictures of the sides of the objects which are turned toward it, especially if those sides are wet. The mode of reflection by which this occurs is illustrated by diagram 6, where the sunlight breaking through a cloud in such a manner that its light falls upon the water at A, upon the sunward side of the ship, the lower edge of the cloud, B, prevents the sun rays from illuminating the ship. The light is reflected from A on to the object, and thence back and upward in the sheaf of reflected rays, C D, to the cloud, B, where a picture is presented with many details not to be found in the shadows of the object, which are cast in the opposite direction or away from the sun. This order of reflection is occasionally reversed by the cloud, B, having its upper instead of its lower edge bounded by the line, C, when the direct sun ray will illuminate the ship, from whence it will be reflected to the water at A, and thence on to the intercepting cloud below the line, C. The image formed by the latter modification will be inverted and that of the former erect.

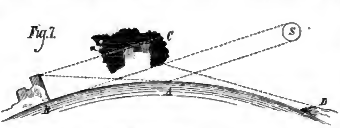


Fig. 7.

Fig. 8.

It is to this phase of atmospheric images that the looming of distant seacoasts is referable. The coast of France, for instance, seen from that of England across the English channel, the north shore of Lake Ontario seen from Rochester, and even the case of the brig on fire, before referred to. This phase of the mirage is capable of being produced at one and the same time with the true shadow form, though no case of its observation has ever been placed on record; it will, nevertheless, be obvious that the light falling upon the water at A is, after its reflection there, reflected by the glittering sails of the wet ship to B. This act of its interception is also the act of producing a shadow of the ship, which will proceed upward bounded by the dotted lines, E F, of the sixth diagram, which, if intercepted anywhere along the course of its projection, will exhibit also an image of the ship differing from that at B, as a shadow differs from a real image, the shadow being in fact but the absence of the light intercepted by the ship and reflected back to B. To make the causes of the looming of coast lines more clear, we present the seventh diagram, where a section of the curvature of the earth is shown. The rays from the sun, S, being incident upon the surface of the water from A to the base of the building on shore, B, are thence reflected on to the building, which in turn reflects them on to the cloud, C, where the picture thus produced may be viewed from the opposite seacoast at D, just as the images of a magic lantern may be viewed from the back of a semi-transparent screen on to which they may be projected.

Such images as the specters of the Brocken are merely ordinary shadows, projected from all mountain tops, which are more or less isolated, on to clouds which happen to lie in their paths. Such localities are visited often without seeing the phantoms, because the sun may not be shining at the time of the visit, or there may be no clouds in the proper place to receive the shadows. Those are the true ordinary shadows cast by sunlight, and are transformed into images in the air by the changing angle of an ascending sun, when they occur upon water surfaces and in the presence of proper backgrounds. An example occurred upon the Lake of Geneva, when a vessel and its shadow were visible at the same time. The image, like the vessel, rested with its hull upon the water, the observer incidentally remarking the occurrence took place early in the morning, which, though indefinite, gives us the cue to the fact that the rising sun was a factor in the transaction. As it came over the horizon, it cast the vessel's shadow horizontally along the surface of the lake, until it was intercepted by one of the banks of fog or morning mist, which occur so frequently on all sheets of water. This image disappeared by ascending into the air while moving horizontally in the opposite direction from that to which the vessel's bow was directed. Had the observer suspected that the sun was in any way connected with the phenomena, he would have informed us whether its course corresponded to that of the vessel, which made little or no progress, as the morning was very still; it was, therefore, a case exactly analogous to that before referred to as having been observed on the south coast of England, where the windmill in the one case occupied the place of the vessel in the other, the phenomena in every other respect being the same, except that the shadow of the vessel seemed elongated horizontally, which was occasioned by the fog bank upon which it was projected, having its face obliquely inclined to the line of the shadow's proportion, while the observer occupied a position more nearly at right angles to the face of the cloud, which also accounts for the distorted appearance which those aerial images so often assume.

Where objects are situated upon water, the ascending of the sun transfers its shadows to the air, and out of the single horizontal shadow produces two, one erect and one inverted. The manner of changing the ordinary horizontal shadow cast by the light into shadows in the air, may be understood by diagram 8, where S is the sun on the horizon, O the object, and A its shadow. When the sun ascends to S', the shadow of the object is projected on to the water from O to P, and thence reflected into the air bounded by the lines, Q R; but the light also falls upon the water to the sunward side of the object, where, being incident at the same angle, it is reflected at the same angle, casting into the air an erect image of the object, O, bounded by the lines, R T, and screen at B. The increasing altitude of the sun correspondingly increases the angle at which those shadows are reflected from the surface of the water, which correspondingly decreases their chances of encountering clouds, hence, those images are only seen when the altitude of the sun is low. The double images of objects at sea, seen in the air, are therefore nothing more than the outgrowth of a single shadow cast by the sun when on the horizon, unfolding, as the sun rises, two shadows out of one, one of which, being the product of light reflected from the sunward side of the ship, must, of course, be right side up, precisely as if cast by direct sunlight. The other is a true shadow, also cast right side up on to the water on the side of the ship opposite to the sun, but is inverted by the act of reflection after its formation, forming a curious illustration of how a single object illuminated from a single point may cast two shadows perfectly distinct from each other.

The mirage of the desert is, however, wholly unassociated with images in the air, as it is merely a case of direct reflection from the surface sands, which being an infinite number of sparkling points lying so closely together as to be optically equivalent to an unbroken reflecting surface, the most elevated portions being more exposed to the luminous conditions of the horizon reflect the most light, and therefore appear as lakes, while the more depressed portions being relatively in shadow relieve the brilliancy by passages comparatively dark, and giving the effect of islands, promontories, etc. Those lakes recede as the traveler advances, seeming constantly to keep their nearest shores about half an hour's march away, because the angle of reflection decreases with distance, and the nearer it approaches to coincidence with the reflecting surface, the greater will be the quantity of light reflected, and, indeed, long before it reaches actual coincidence (that is to say, long before the line of vision rises to the horizon), the angle of total reflection has been passed. In other words, when a line drawn from the eye of the observer to a point upon the plain upon which he is standing makes with that plain an angle of 53°, all beyond that must be of necessity very brilliant, for it is reflecting all the light of the horizon, minus, of course, a little due to inequalities of the land surface.

That nature should use her clouds for screens to exhibit her pictures upon is not at all to be wondered at, as they are the only background material she has in the regions where she makes the display, nor is it at all extraordinary or exceptional, for the earliest artificial presentations of aerial figures were made in the same manner and long before the use of the magic lantern was known beyond the cloisters of the mediæval monks, who sometimes exhibited to a carefully selected and exceptional few what they designated the magic circle, accompanying the exhibition with impressive ceremonies and incantations. A circle was described, from the center of which the smoke of burning incense ascended, and upon or in this smoke appeared the demons evoked, writhing and twisting into all imaginable forms through the moving volumes of ascending smoke. Outside the circle were placed the audience, forbidden to cross its boundary under pain of instant destruction by the fiends presented there, who were supposed to be of a peculiarly malignant nature and not always controllable by those who had the power to evoke them. Like other specters of the air, they would at one time appear very distinct, then fade away to invisibility, which depended, of course, upon the changing density of the vapor.

The facts, however, are valuable in this connection, as showing the use of cloud screens for exhibiting images upon, and some of the most clever tricks of modern necromancy are performed in the same manner; no reason, therefore, exists why nature should be incapable of using the same means

as cleverly as a mountebank, especially as she has such an abundance of ready-made screens always on hand and to spare.

Peculiar Mines in Colorado.

In a recent lecture before the Bullion Club, Professor J. S. Newberry described several new and peculiar mineral deposits which he had been studying in Colorado. In the course of his remarks he said:

I ventured to predict some time ago that Leadville was destined to be as important a gold camp as a silver camp, and my words were verified so far that from eight to ten million dollars of gold were taken out of the California Gulch. Now, the question is, how did the gold come there? Up to the present time it has not been fully traced to its source, and I made up my mind there were discoveries to be made that would surprise people. The development of the "Colorado Prince" is one of these surprises, and I venture to say not the last one.

The gold here is found between a stratum of limestone and porphyry, the limestone being below. The deposits are not in the same form as the bog iron ores, as is generally supposed. They are composed of decomposed iron with iron pyrites, sulphide of iron, sulphide of lead, with more or less of other matters. These ores are mixed in a heterogeneous mass. When they come to be oxidized the iron floats on the top, and as we go lower and lower we find the vein grows richer—in gold and silver principally. This deposit, as I said, is found in a cavity formed between the limestone and porphyry, and my judgment is that that cavity was formed by the action of surface carbonated water that percolated through and made that line of drainage. Then the stream down this line cut out the limestone by solution and left the cavity, which has been filled in by this rubbish, which in due time became oxidized and brought into the condition in which we find it. If we follow it lower down we shall find solid pyrites instead of sulphides. These will contain as much valuable ores, although a different treatment will be necessary in roasting or smelting.

Of the mines of this description the "Highland Chief" is one of the most extraordinary, simply from the magnitude of the deposit. The structure is similar to that of the "Colorado Prince." As to the workings there is a shaft of 88 feet, cutting through the porphyry, and striking the ore body. From this to a depth of 162 feet there is no bottom to the ore. This most extraordinary deposit is a type of these mines which I have been describing. No one knows at present the extent of this fissure, but it seems not improbable that it will be one of the great gold fields of the world. It is certainly, in my opinion, one of the most promising gold fields that has been discovered on this continent. No portion is taken out that will not pay for working it. While I was there thirty tons gave a return of $50.95 per ton. I do not know of any gold mine in the world, with a width of 60 or 80 feet, that will average $50 to the ton. The California mines, from 10 or 12 to 15 feet in width, return about $15 to the ton; in the Black Hills, in gold mines which are really paying, a width of 150 to 175 feet carries $8, $9, and $11 a ton. Now all of us who know anything about mining do not want any property better than that. Where you have a great quantity of quartz containing gold, and cheaply worked—as most of this hard freed rock can be—and find it will stand two tons to the stamp, at $5 per ton, no better profit could be desired. But these mines at Leadville show promise of a much larger profit. I do not mean to say they are better than all other mines, but at present the deposits are found to be entirely beyond parallel. Their value runs from $3,400 to $2 and a fraction per ton. The Silver Cliff, Racine Boy, Bassick, and other mines there are not yet understood, and their geological formation has been misrepresented.

Characteristics of Central Australia.

In the *Victorian Review* for January, Mr. Richard Bennett gives, from personal observation, some account of the little known country lying north of the river Murray, and extending to the great interior called Central Australia, a region which, by the application to it of a comprehensive system of irrigation, might be brought under cultivation, he thinks, and rendered capable of carrying a large population.

The country north of the Murray and Darling rivers, stretching away to Cooper's Creek, is one vast extent of alluvial plains, interspersed with sand ridges, dry lakes, or large depressions surrounded with high banks, and occasional isolated hills, few and far between. A peculiarity of the sand hills or ridges is that they run generally parallel to the large rivers, and between them are flats of very rich black soil, generally covered with myall trees, which yield a transparent gum in large quantities, in all respects resembling gum arabic, perfectly soluble in water, and eaten by the blacks in the neighborhood of the large rivers as an accompaniment to fish and opossum. Mr. Bennett accounts for the parallel formation of the sand ridges, first, by the prevalence of easterly winds sweeping down the valleys between them; next, by the back-water finding a vent over the intermediate flats to the river below during exceptionally high floods.

The sand ridges lying between the Lower Murrumbidgee and Darling are, in many instances, densely covered with spinifex, or, as it is called in those parts, porcupine grass. Nothing eats it, except after the tussocks have been burnt, when sheep are fond of the young green shoots. On the myall flats, between the sand ridges, grasses of the most nutritive description grow, particularly a kind called blue grass, and foxtail, and a great variety of vetches and saltbush; and there are large tracts of depressed plains subject to inundation from floods, formed of rich black plastic soil (like butter in wet weather, and dry and crumbly in summer time), that is covered with wild carrots and a very fine description of wild flax, the bolls of which, especially when the seed is ripe in October, fatten stock rapidly. Sheep graze over the carrot ground when not a vestige of anything green is to be seen on the top, scraping with their forefeet till they get sufficient hold with their teeth on a carrot to pull it out. These carrots have a bitter astringent taste, but are very fattening.

One chief characteristic of this country is the total absence of stone of any description, except in the neighborhood of isolated mountains and hills, some of which are two or three hundred miles apart.

The whole of this flat country, in Mr. Bennett's opinion, has been in ages long past either a vast inland sea, or succession of lakes. With the gradual rise of the continent the waters of these have drained off through the great valleys of the Darling, Murrumbidgee, and other tributaries into the Murray, and have thence been conveyed to the sea. As the drainage went on, large deposits of alluvium were brought down from the mountain ranges in the form of impalpable mud, the drainage of rich up-country river flats and mountain gullies. Some very curious phenomena are occasionally met with. Mr. Bennett has frequently come upon a small plain covered thickly with small nodules of ironstone like peas or buckshot, as if they had rained there, yet outside this particular spot not one was to be found. Again, when riding through the mallee near the Murrumbidgee, his horse sometimes sank up to the girths in a dry white powder like flour, probably some formation of lime. At the Oxley station, on the Lower Lachlan, some forty miles from Balranald, there is a stratum of gypsum in pure crystals, three or four feet in thickness, at a depth of five or six feet from the surface, and the gypsum crops out of the bank of the river.

Throughout these regions no large timber is to be found, except the blue gums, which fringe the large rivers, and which are never found beyond the limit of the river flats. The sand ridges are usually, though not always, covered with pine forests, many trees attaining a height of nearly one hundred feet and a girth of six or seven feet. There is likewise a species of forest oak called belar, which attains a height of fifty to sixty feet with a girth of five or six feet. This timber is exceedingly hard, heavy, dark-grained, and very brittle. This timber grows almost exclusively on red soil, very porous to water, and there are very extensive forests of it. These three species comprise all the large timber. There are forests or flats of yellow box, also of myall or boree; but neither of these attains a size to warrant its being classed as useful timber.

The rest consist of mallee, growing on desolate sandy country, too often covered with spinifex; yarren, which is tall, slender species of myall, forming thick scrubs; mulga, a poisonous wood growing abundantly about the Darling, Warrego, Paroo, and Bulloo in Queensland; the quandong tree, which grows to the size of an ordinary cherry tree, and bears a red fruit surrounding a yellow indurated stone, in much request for ladies' ornaments, such as buttons, bracelets, etc.; the colane tree, which grows about the Lower Macquarrie and Bogan rivers, the handsomest tree of them all, with a thick foliage of a brilliant bright green, and bears a fruit of dark crimson color, of a very agreeable acid flavor, about the size of a walnut, inclosing a stone very much the size of a nutmeg, and quite solid. The wood of this tree is rather like the English beech, but is very short in the grain, and useless for building or other purposes. There is likewise a tree, called by the blacks yambang, which grows about the Lower Bogan and Macquarrie rivers; it is called by the settlers the native pomegranate, and has a fruit much resembling a Seville orange in size and color when ripe, full of seeds, about the size of small orange pips, embedded in a thick luscious fluid, very agreeable and refreshing when perfectly ripe, but when green, one taste would satisfy the greatest epicure; it is something akin to a compound of turpentine and cayenne pepper, the latter ingredient rather in excess.

There is a smaller species, which is a climbing plant, and grows in the scrub, with a fruit about the size of a pigeon's egg. The taste of this, both in its ripe and unripe state, is almost identical with the large sort; but the rind is very thin, while that of the large sort is thick. Another singular tree is the leopard tree, which grows to a diameter of about a foot. It derives its name from the spotted appearance of its bark, which is studded with scales of the size of a shilling; it bears a pod with a very aromatic scent and flavor. Many aromatic trees and shrubs grow in the scrub, some of which doubtless possess valuable medicinal properties, were they fully investigated.

It was on the Lower Bogan River that Allan Cunningham, the botanist, and a member of Sir Thomas Mitchell's exploring party, was killed by the blacks at a place now known as the "Murdering Stump."

The herbage throughout these extensive districts is mostly saline, consisting of a large variety of saltbush, pigface, cottonbush, portulacca, etc. The absence of large forest timber, stones, and the saline nature of the herbage indicate the comparatively recent formation of this part of Australia. Small conical hills are occasionally met with, one of which in particular, rising out of a plain within a few miles of the Macquarrie marshes, or mole, in a country otherwise totally devoid of stone, is composed of huge granite rocks, and, on riding round it, a hollow vibratory sound is produced, as if large caverns existed. These hills and isolated mountains are, in Mr. Bennett's opinion, the summits of what were once islands, many of them of volcanic origin. Mr. Bennett believes that underneath the whole of this flat country there is an enormous body of fresh water, and that artesian wells will be the cheapest and most efficient means of irrigation.

Archæological Explorations in Missouri.

At a recent meeting of the Boston Society of Natural History, Mr. F. W. Putnam gave some account of the shell heaps of the Atlantic and Pacific coasts of North America, and stated that there had been received at the Peabody Museum a small collection of articles taken from some rude dolmens lately opened by Mr. E. Curtiss, who is now engaged, under his direction, in the work of exploration for the museum. These chambered mounds are situated in the eastern part of Clay county, Missouri, and form a large group on both sides of the Missouri river. The chambers are, in the three opened by Mr. Curtiss, about 8 feet square, and from 4½ to 5 feet high, each chamber having a passageway several feet in length and two in width, leading from the southern side, and opening on the edge of the mound formed by covering the chamber and passageway with earth. The walls of the chambered passages were about 2 feet thick, vertical, and well made of stones, which were evenly laid without clay or mortar of any kind. The top of one of the chambers had a covering of large flat rocks, but the others seem to have been covered over with wood. The chambers were filled with clay which had been burnt, and appeared as if it had fallen from above. The inside walls of the chambers also showed signs of fire. Under the burnt clay, in each chamber, were found the remains of several human skeletons, all of which had been burnt to such an extent as to leave but small fragments of the bones, which were mixed with the ashes and charcoal. Mr. Curtiss thought that in one chamber he found the remains of five skeletons, and in another thirteen. With these remains there were a few flint implements and minute fragments of earthen vessels. A large mound near the chambered ones was also opened, but no chambers were found therein; neither had the bodies been burnt. This mound proved very rich in large flint implements, and also contained well made pottery, and a peculiar "gorget" of red stone. The connection of the people who placed the ashes of their dead in stone chambers with those who buried their dead in the earth mounds is, of course, yet to be determined.

Interglacial Quartz Workers in Minnesota.

In 1876 Prof. Winchell found in and around Little Falls, Minnesota, a number of fragments of wrought quartz in surface deposits underneath the remains of the mound builders. Prof. Winchell, accordingly, fixed the era of the quartz workers between that of the mound builders and the close of the glacial epoch.

At a late meeting of the Historical Society, at Minneapolis, Minn., Francis E. Babbit gave an account of a considerable deposit of quartz chips and implements found in regular strata, which must have been formed before the close of the glacial period. The specimens consist of hammers, implements, etc., both finished and unfinished, together with the chips struck off from the articles in the process of manufacture. The material of which they are composed is principally compact, lustrous quartz, frequently mottled as if selected with an eye to the artistic beauty. The stratum is some few inches in thickness, and lies in the soil a few feet below the surface. The appearances indicate that this was once the site of a manufactory of such quartz objects, and this idea is upheld by various considerations. There are tools found such as would be used in the manufacture of quartz articles, and the whole stratum is mixed with chips, which in many cases appear stuck in the dirt just as they fell from the hand of the unknown. Unfinished implements are also found in more or less advanced stages of manufacture. It is not possible to fix the precise point occupied by these remains in the scale of the glacial epoch until the drift features and surrounding formations of the locality shall be better understood than now. Still it is certain that the remains belong to a people living before the end of the last glacial period, because they are deposited in a drift which is known to be of glacial origin. The hard pan upon which the quartz formations lie is probably of the first glacial period, and the quartz may belong to an inter-glacial epoch.

Beet Sugar in Maine.

The past year's work of the Maine Beet Sugar Company at Portland was not bad for a beginning. In a report to the 1,700 farmers who raised the beets the company say that the average crop from 100 acres was 9½ tons; in some cases the return was not enough to pay cost of seed and fertilizers; the other extreme was 30 tons per acre. For 9,000 tons delivered at the factory, $56,000 were paid; for storing and pitting, $8,000; fuel, $10,000; labor and other expenses, $37,000; total, $107,000. The product, 900 tons of sugar and molasses, brought $110,000, leaving $3,000 toward machinery and fixtures that cost $80,000, to which must be added the State bounty. The company wish to continue the experiment, and invite the growers to renew their contract for at least one acre each. They say, however, that they cannot afford to increase the price per ton, except for early deliveries, which can be worked up before freezing weather, and thus save expense of pitting.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

OFFICE OF AMERICAN AGRICULTURIST, NEW YORK, July 22, 1879.

H. W. Johns M'f'g Co., 87 Maiden Lane, New York.

DEAR SIRS:—I have used your Paint upon outside work of my house, and can already see that the work done with it is superior to that done with the Lead and Oil Paint.

I am much pleased with the Paint, and wish now to try the pure white for inside work, etc. Yours truly,

HENRY STEWART.

For Sale.—Works completely equipped for the manufacturing of Carriage Axles. Is well located to coal and iron; also very accessible to market. Address B. P. Bullard, 14 Dey St., New York.

All kinds Machine Drawings. Inventor's work a specialty. Hours, 9 to 6. Wm. D. Skidmore, 238 Broadway, New York.

Brass Castings; bottom prices. H. B. Morris, Ithaca, N. Y.

For Alcott's Improved Turbine, see adv., p. 204.

Boiler Feed Pump, with tight and loose pulleys; sure to work. Price $33. York & Smith, Cleveland, O.

For Sale.—An Agricultural Establishment, consisting of two story wood and machine shop, foundry, office, and storeroom; water power. Address Box "I," Weldon, N. C.

Wanted—The address of the manufacturers of Union Spring Churn. G. W. Collins, Patentee. F. A. Griffin, Clyde, Kansas.

We are frequently asked, "Which is the largest, best, and most reliable retail clothing house in New York?" To one and all we say, Baldwin the Clothier's.

The American Institute in New York have recently adjudged that the Esterbrook Steel Pens are "the best in use." They can be had of all stationers.

Judson's Sectional Assay Furnaces. Improved muffle and revolving grate. W. E. Judson, Cleveland, O.

Boat Engines, for sidewheel boats drawing 6 to 12 in; direct acting; link motion; cheap. Box 103, Owego, N.Y.

Machines for Tapping Water Mains under Pressure. Apply at Easton Brass Works, Easton, Pa.

For Sale.—Four Boilers, 100 horse power each, return drop flue; A 1 condition; $1,300 each. 1 Berryman Heater, 42 x 96; A 1 condition; $400. D. L. Einstein, 16 White St., New York.

Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

Pech's Patent Drop Press. See adv., page 173.

Spokes and Rims, white oak and hickory, best quality, to any pattern, and Hammer Handles of best hickory. John Fitz, Martinsburg, West Va.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 205.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Portable Forges, $12. Roberts, 107 Liberty St., N. Y.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 189.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Solomon's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad., page 173.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 188.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 189.

Portable Railroads. Sugar Mills. Horizontal & Beam Steam Engines. Atlantic Steam Engine W'ks, B'klyn, N.Y.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 205.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Walrus Leather, Solid Walrus Wheels; Wood Wheels covered with walrus leather. Greene, Tweed & Co., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 204.

We will purchase or manufacture on royalty, patented articles of real merit. Farley & Richards, Phila., Pa.

Silent Injector, Blower, and Exhauster. See adv. p. 205.

Millstone Dressing Machine. See adv., page 206.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Linen Hose and Rubber Hose of all sizes, with or without coupling. Greene, Tweed & Co., New York.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 730 Broadway, N. Y.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 17.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable, and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

New Economizer Portable Engine. See illus. adv. p. 206.

Fine Taps and Dies in Cases for Jewelers, Dentists, and Machinists. Pratt & Whitney Co., Hartford, Conn.

Catechism of the Locomotive. 625 pages. 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 206. Totten & Co., Pittsburg.

For Patent Shapers and Planers, see ills. adv. p. 188.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. B. M.—1. Argillaceous lime carbonate. 2. Calcite. 3. Celestite, contains about 50 per cent of strontia. 4. Fluorspar in quartz. 5. Hematite.—P. H. S.—An impure kaolin; it would hardly pay to work.—F. B. Mc.—It is magnetic iron sand mixed with menaccanite, or titaniferous iron and quartz sand; no chromium present.—C. M.—It is a fine silicious clay, it might be useful for some polishing purposes and in the manufacture of certain kinds of pottery, but it would hardly bear transportation East.—T. S. S.—It is an argillo-silicious lime carbonate, possibly a good cement stone. It might repay an analysis.—J. B. C.—It is quartz.

COMMUNICATIONS RECEIVED.

On Sun Spots. By A. E. H.
On Uniformity of Gauge. By J. R.
On a New Ellipsograph. By D. N. G.
On Filing. By R. G.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 2, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air compressor, J. H. Parkinson ... 225,161
Air cooling apparatus, W. S. Wilkinson ... [illegible]
Animal trap, W. S. Kisinger ... 225,144
Annunciator, electro-magnetic, A. Beach ... [illegible]
Axle box, car, C. Barrett ... [illegible]
Axle box, car, Crockett & Barrett ... [illegible]
Axle box, vehicle, J. W. Truebload ... [illegible]
Axles, ball and socket coupling for vehicle, J. Simonson ... [illegible]
Balance wheel connecting device, B. Merritt ... [illegible]
Bedstead, invalid, C. M. Campbell ... [illegible]
Berth, pendulum, F. Gardner ... [illegible]
Binder, temporary, A. D. Hoffman ... [illegible]
Blind, window, J. M. Farrier ... 225,117
Boiler furnace, W. M. Fisher ... [illegible]
Boot and shoe counter brace, J. G. Whittier ... [illegible]
Boot, plowman's, S. Brown ... [illegible]
Boots and shoes, making rubber, G. M. Allerton ... [illegible]
Boots, combined counter stiffener and insole for rubber, G. D. Margraf ... 225,016
Box filler, automatic, R. Pickering ... [illegible]
Brick machine mould, G. Carnell ... 225,109
Buckle, I. L. Landis ... 225,147
Building houses, barns, fences, etc., J. M. Leeds ... [illegible]
Bung, J. Brown, Jr. ... [illegible]
Bung, J. Kirby (r) ... 9,107
Car coupling, J. D. Aycock ... [illegible]
Car coupling, J. H. Henley ... [illegible]
Car draw bar, freight, C. Barrett ... [illegible]
Car draw bar, railway, D. Hutt ... [illegible]
Car, freight, C. Barrett ... [illegible]
Car, freight, L. Myers ... 225,187
Car roofing, C. A. Smith ... [illegible]
Carriage spring, H. W. Avery ... [illegible]
Cartridge box, V. Sauerbrey ... [illegible]
Caster, distributing, H. Kahler ... [illegible]
Cement, glue, J. Firmbach ... [illegible]
Chain, drive, W. D. Ewart ... 225,113
Check box, restaurant, W. H. H. Wood ... [illegible]
Check rower, J. Putman ... [illegible]
Churn, J. Gehr ... [illegible]
Clamp, G. J. Dickson ... [illegible]
Clock case, Davies & Somers ... 225,112
Clothes slide, W. N. Wylie ... [illegible]
Collar, horse, M. Turley ... [illegible]
Coloring matter obtained from alpha-naphthol, H. Caro ... [illegible]
Columns, combined capital and base for metallic, J. Johnson ... [illegible]
Commode, J. B. Wortham ... [illegible]
Cooking utensil, J. M. Webb ... [illegible]
Corn drill, R. L. Benedict ... [illegible]
Corn husking machine, F. Rose ... [illegible]
Core anchor and stud, C. D. Woodruff (r) ... 9,103
Counter and heel protector, A. A. Norman ... [illegible]
Curtain cord tightener, H. Rosley ... [illegible]
Curtain, dust and salvage cornice, W. M. Brackett ... [illegible]
Die and former, Blum & Schoettle ... [illegible]
Ditch cleaning machine, W. P. Smith ... [illegible]
Dredging machine, E. Williams ... [illegible]
Egg beating apparatus, T. Earle ... [illegible]
Elevators by railway cars, device for operating, N. Nolan ... [illegible]
Excavating machine, J. T. Douglas ... [illegible]
Fare register, J. B. Benton ... [illegible]
Feathers for dusters, machine for preparing, C. H. Law ... [illegible]
Feed trough for stock, J. M. Irwin ... [illegible]
Fence, portable, J. Peabody ... [illegible]
Fence, metallic, H. Marsh ... [illegible]
Fencing, stretcher for straining metallic, J. & W. M. Brinkerhoff ... [illegible]
File, bill, H. E. Roberts ... [illegible]
File blanks, die for making half round, A. Ridal ... [illegible]
File handle, C. M. Fairbanks ... [illegible]
File, letter, W. A. Amberg ... [illegible]
Firearm, breech-loading, V. Sauerbrey ... [illegible]
Fire kindlers and fuel, machine for moulding, M. B. Coburn ... [illegible]
Flour, making self-raising, H. C. Dart ... [illegible]
Flour packer, A. W. Straub ... [illegible]
Fluid meter, J. B. Norfolk ... [illegible]
Fulling and scouring process and material for, J. W. W. Martin ... [illegible]
Furnace grate, A. Kohlhofer ... [illegible]
Fuse, electric, H. J. Smith ... 225,173
Gas lighting device, electric, H. F. Packard ... [illegible]
Gate, J. T. & O. G. Wagers ... [illegible]
Grain binder, S. D. Locke (r) ... [illegible]
Grain binder, C. B. Withington ... [illegible]
Grain separator, magnetic, Thayer & Cook ... [illegible]
Grate front, H. D. Purvell ... [illegible]
Grinding mill, J. J. Faulkner ... [illegible]
Grinding mill, S. C. Schofield (r) ... 9,100
Grist mill alarm attachment, W. H. Hottel ... [illegible]
Gun magazine, A. Burgess ... [illegible]
Harness loop press, J. L. Barkley ... [illegible]
Harrow, J. H. Barley ... [illegible]
Harrow and roller, combined, Ring & Mooney ... [illegible]
Harvester, Kromer & Rinkleff ... [illegible]
Hat and other head covering, reversible, L. Girhardt ... [illegible]
Hat tip, J. Bigelow ... [illegible]
Hedge fence layer, F. Poole ... [illegible]
Hoe and rake, I. A. Murchison ... [illegible]
Hog cholera compound, W. Benton ... [illegible]
Hoop machine, barrel, G. A. Ramp ... [illegible]
Horses, safety appliance for releasing, B. F. Strange ... [illegible]
Hose pipe nozzle, Alderson & Loftus ... [illegible]
Hose reel, B. J. Stoner ... [illegible]
Hot air register, E. A. Tuttle ... [illegible]
Hot air register, S. Tuttle, Jr. ... [illegible]
Ice, apparatus for making, A. J. Zither ... [illegible]
Ironing board clamp, E. W. Warren ... [illegible]
Ironing machine, M. Steinbock ... [illegible]
Ironing table, S. S. Case ... [illegible]
Kegs, etc., cover for, A. J. Robinson ... [illegible]
Knob attachment, W. H. Gonne (r) ... 9,101
Label holder, T. B. Bishop ... [illegible]
Lamp burner, H. W. Hayden ... [illegible]
Liquids from casks, etc., apparatus for drawing, E. L. Starck ... [illegible]
Lock box cover, W. B. Hamilton ... [illegible]
Loom drop box mechanism, J. Doering ... [illegible]
Matches, shipping package for, O. C. Barber ... [illegible]
Mattress frame, woven wire, D. J. Powers (r) ... [illegible]
Mattresses, tightening device for woven wire, D. J. Powers (r) ... [illegible]
Metal rods, device for cutting off and screw-threading, D. Burin ... [illegible]
Metallizing fibrous, cellular, and porous substances, H. Waitz ... [illegible]
Nail making machine, N. C. Lewis ... [illegible]
Navigation, device for slack water, H. Haupt ... [illegible]
Nut lock, Hackman & Tinsley ... [illegible]
Nut lock, V. G. Henry ... [illegible]
Ore feeder, H. M. Ransom ... [illegible]
Oyster tongs, W. L. Messick ... [illegible]
Package box, G. C. Wenzel ... [illegible]
Paper bags, machinery for making first folds of satchel-bottom, S. E. Pettee ... [illegible]
Paper box, F. Knobeloch ... [illegible]
Paper machines, suction or vacuum box for, Jordan & Markle ... [illegible]
Paper trimming and slitting machine, B. Binns ... [illegible]
Pen, marking, J. W. Stanton ... [illegible]
Pianoforte agraffe, E. T. Bowlby ... [illegible]
Pianoforte and organ, combined, J. T. Wright ... [illegible]
Pianoforte tuning pin lock, L. W. Norcross ... [illegible]
Pile, tubular, J. Johnson ... [illegible]
Pistol rest, I. Kinney ... [illegible]
Planter and cultivator, combined, J. Bennett ... [illegible]
Planter, seed, A. B. Pierson ... [illegible]
Plow, J. G. Gross ... [illegible]
Plow, H. Sattler ... [illegible]
Plow and colter, swivel, J. P. Holley ... [illegible]
Plow attachment, B. L. Sims ... [illegible]
Plow, sulky, F. C. Bryan ... [illegible]
Plow, sulky, W. D. Jaye ... [illegible]
Plow, wheel, W. D. Miller ... [illegible]
Pocket, safety, M. A. Adler ... [illegible]
Portfolio stand, B. P. Shillaber ... 225,111
Press, R. S. Hamilton ... [illegible]
Pressure regulator, N. C. Locke ... [illegible]
Printing machine delivery apparatus, C. Kahler ... [illegible]
Pump, E. Lannay ... [illegible]
Pump, cistern, M. Wieser ... [illegible]
Purse or wallet protector, A. Whitenack ... [illegible]
Railway frog, J. C. Center ... [illegible]
Railway signal, R. B. Ireland ... [illegible]
Railway switch bar, G. W. Whipple ... [illegible]
Railway turn table, elevated, C. Dunkersley ... [illegible]
Refrigerating apparatus for hydrants and street fountains, G. F. Blinsinger ... [illegible]
Refrigerator, W. F. Clapp ... [illegible]
Refrigerator, E. P. Koonts ... [illegible]
Rock drill, A. W. White ... [illegible]
Roofing composition, G. W. Bender ... [illegible]
Rotary chair, A. H. Ordway ... [illegible]
Rotary engine, W. N. De Groat ... [illegible]
Rotary engine, E. Waldron ... [illegible]
Safe, Berkmyer & Brown ... [illegible]
Salt evaporator, J. P. Sinclair ... [illegible]
Sash supporter, W. W. Sweetland ... [illegible]
Saw machine, drag, E. C. Best ... [illegible]
Saw machine, drag, W. J. Pulliam ... [illegible]
Scales, pendulum weighing, J. Goodale ... [illegible]
Sewing and other machines, cabinet for, G. W. Burgess ... [illegible]
Sewing button holes, overseaming, etc., machine for, W. M. Smith ... [illegible]
Sewing machine hand power, G. P. Herndon ... [illegible]
Sewing machine motor, R. Whitehill ... [illegible]
Sewing machine treadle, D. Leib ... [illegible]
Shaft coupling, C. Q. Hayes ... [illegible]
Shutter worker, H. G. Dudley ... 225,118
Speaking and signaling apparatus, comb'd house, C. Hinkler ... [illegible]
Speculum, rectal, A. W. Brinkerhoff ... [illegible]
Spinning frame spindle, G. B. Taft ... [illegible]
Spray dampener, H. Humphreville ... [illegible]
Stamp, perforating, Barlow & Taylor ... [illegible]
Starching machine, Longworthy & Norris ... [illegible]
Station indicator, Herbert & Layton ... [illegible]
Steam boiler, J. D. Ogle ... [illegible]
Steam boiler feeding apparatus, E. Fromentin ... [illegible]
Steam boiler, portable, W. B. Michener ... [illegible]
Steam engine, L. Thomas ... [illegible]
Steam engine lubricator, A. L. Harrison ... [illegible]
Stone crusher, C. M. Brown ... [illegible]
Stove lid, J. J. Lowden ... [illegible]
Stump puller, J. S. Molhollen ... [illegible]
Suspender straps or ends, material for, O. Kleinberger ... [illegible]
Suspenders, H. & W. Turner ... [illegible]
Swift, C. C. R. Van Alstine ... [illegible]
Table, J. R. Thomas ... [illegible]
Tablets, slating compound for erasible, H. W. Holly ... [illegible]
Tap for barrels, measuring and registering, E. J. Shaw ... [illegible]
Tape holder, E. Rice (r) ... 9,106
Telegraph, duplex, F. W. Jones ... [illegible]
Telephone, mechanical, J. J. Stall ... [illegible]
Textile and other fabrics, machine for cutting, A. & H. Warth ... [illegible]
Thill coupling, W. Harder ... [illegible]
Ticket, railway, A. B. Groff ... [illegible]
Tobacco curing furnace, J. C. Millner (r) ... 9,108
Tobacco, machine for pressing and cutting plug, L. W. Spencer ... [illegible]
Tooth extractor, W. Cunnington ... [illegible]
Traction engine, C. G. Cooper ... [illegible]
Tube forming machine, L. S. White ... [illegible]
Type writing machine, F. Sholes ... [illegible]
Vapor burner, F. A. Lyman ... [illegible]
Varnish, lacquer, etc., apparatus for boiling, J. Werner ... [illegible]
Vase and flower pot suspender, C. B. Pettengill ... [illegible]
Vegetable cutter, J. De Frain ... 225,114
Vehicle dash fastening attachment, G. M. Peters ... [illegible]
Vehicle foot rail, W. F. Black ... [illegible]
Vehicle spring, J. B. Whitcomb ... [illegible]
Velocipede, C. Hammelmann ... [illegible]
Wagon body corner iron, J. Gorham ... [illegible]
Wagon brake, P. Jarvis ... [illegible]
Washing machine, Hauden & Spainhower ... [illegible]
Water, etc., apparatus for purifying, A. R. Lendner ... [illegible]
Weather strip, J. T. Westbrook ... [illegible]
Wells, apparatus for flooding oil, H. H. Davis ... 225,111
Whip and rein holder, combined, G. D. Anderson ... [illegible]
Window netting, C. T. Phelan ... [illegible]
Wrench, H. P. Hood ... [illegible]
Yarn, apparatus for detecting knots in, R. Altoth ... [illegible]
Yoke, neck, H. Jacobs ... [illegible]
Yoke center swivel, neck, J. Jacobs ... [illegible]

DESIGNS.

Bracelet, J. A. Lieb ... 11,064
Carpet, W. J. Gadsby ... 11,062, 11,063
Carpet, T. J. Stearns ... [illegible]
Glass vessels, W. H. Warner ... 11,067
Spoon handles, A. Furniss ... 11,061
Watch chain attachment, S. H. Mace ... [illegible]
Watch chain attachment or end piece, E. F. Nortemann ... 11,065

TRADE MARKS.

Cigars, cigarettes, and chewing and smoking tobacco, M. I. Hampton ... [illegible]
Medicinal preparation, certain, Lanman & Kemp ... [illegible]
Tobacco, chewing, Allen and Ellis ... [illegible]
Tobacco, manufactured chewing and smoking, Allen & Ellis ... 7,841, 7,842
Tobacco, plug chewing, Allen & Ellis ... [illegible]
Urinary organs, remedy for diseases of the, C. A. Cook ... [illegible]
Washing powders, J. Oakley & Co. ... [illegible]

English Patents Issued to Americans.

From February 27 to March 2, inclusive.

Boots and shoes, manuf. of, R. S. Pratt, Chicago, Ill.
Elevators for buildings, B. Slusser et al., Sidney, O.
Electric dynamo machine, C. F. Brush, Cleveland, O.
Engine governors, N. E. Nash, Westerly, R. I.
Explosives, J. Pattison, Nevada City, Cal.
Furnace for boilers, F. W. Brainerd, Freeport, Ill.
Galvanic battery, H. E. Hunter, Hinsdale, N. H.
Knife polishing machine, W. S. Guinness, N. Y. city.
Pens, fountain, A. M. Sutherland et al., Brooklyn, N. Y.
Pumps, G. H. Felt, New York city.
Rolling machine, G. Parr, Buffalo, N. Y.
Shearing textile fabrics, apparatus for, D. C. Sumner et al., Millbury, Mass.
Sugar moulding apparatus, C. H. Hersey et al., Boston, Mass.
Stave machine, E. & B. Holmes, Buffalo, N. Y.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

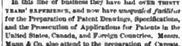
To Business Men.

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is ten times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. If it is worth 25 cents per line to advertise in a paper of three thousand circulation, it is worth $4 per line to advertise in one of forty-eight thousand.

The circulation of the SCIENTIFIC AMERICAN is guaranteed to exceed FIFTY THOUSAND every week.

For advertising rates see top of first column of this page, or address

MUNN & CO., Publishers,
37 Park Row, New York.



CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents, and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since September 11, 1866, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

PROSPECTUS

OF THE

Scientific American

FOR 1880.

The Most Popular Scientific Paper in the World.

VOLUME XLII. NEW SERIES.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular résumé of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

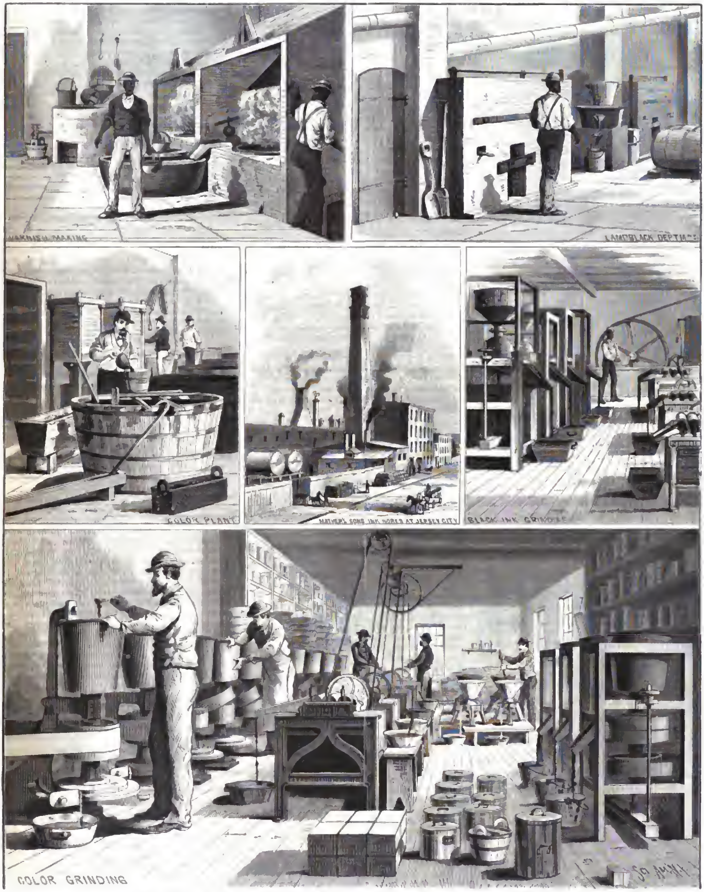
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 15. [NEW SERIES.] | NEW YORK, APRIL 10, 1880. | [$3.20 per Annum. (POSTAGE PREPAID.)]



THE MANUFACTURE OF PRINTING INKS—GEORGE MATHERS' SONS' INK WORKS, JERSEY CITY, N. J.—[See page 229.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, APRIL 10, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 223.
For the Week ending April 10, 1880.

Price 10 cents. For sale by all newsdealers.

AMERICAN EXHIBITS AT THE BERLIN FISH SHOW.

The Commission to represent the United States at the International Fish Exhibition, to open in Berlin, April 20, sailed from this port March 20. At the head of the Commission is Professor G. Brown Goode, curator of the National Museum. His assistants are Mr. Frederick Mather, in charge of the apparatus used in fish culture; Mr. T. W. True, assistant in natural history; Mr. E. G. Rockwell, secretary; Captain J. W. Collins, of Gloucester, Mass., expert in sea fisheries; and Mr. J. Palmer, taxidermist.

The exhibits carried out by the Neckar comprised fully 7,500 specimens, having an aggregate bulk of 175 tons. They will be arranged as follows: Section 1 will contain casts, photographs, and alcoholic specimens of North America. Edible and useful fish, oysters, clams, mussels, etc., with crustaceous turtles, and the algæ. Animals and birds which prey upon fish will be shown in this section; also water snakes, edible frogs, and gulls, and other creatures used for bait.

The second section is devoted to plans, charts, and models of our coast fishing grounds, with relief models of the Atlantic coast to a depth of 200 fathoms, as far north as Newfoundland. These models were made by Mr. C. Lindenkohl. The geographical distribution of our food fishes, oysters, etc., is shown on maps devised by Professor Goode. The whaling interest will be similarly represented; also the sealing grounds off the Alaska coast, the latter charts, the work of Mr. H. W. Elliott, being exhibited by the Alaska Commercial Company. In the third section will fall the various apparatus used in fishing, a number of leading manufacturers being represented by their best work. Fish preserving apparatus will be shown in this section, also models of all the styles of boats used by fishermen, some forty in number, fully rigged, folding boats, canvas, etc. Six figures in fishermen's costumes and the various articles employed in the fisherman's personal outfit will be shown.

Section 4 shows plans and models of factories which turn out fish products, such as guano, oils, glues, gelatine, and the edible preparations, as shown in oyster packing, canning, drying, and salting.

Section 5 will contain the innumerable substances derived from fish, either used for food or employed in the arts. Boston, New York, Baltimore, and San Francisco have sent assortments of canned goods, and all our leading manufacturers will be represented. There are not less than 150 different kinds of fish food. Of American oils there are 60 varieties.

Section 6 contains the apparatus used in the artificial hatching of fish eggs and in rearing young fish. The exhibition made by the United States Fish Commission will probably gain especial distinction in this department. Under the direction of Professor Baird, a map has been constructed showing all the points where fish culture has been introduced throughout the country, with the dates of introduction, the amount of money appropriated either by the general or State government—in short, a chart showing at a single glance the wonderful progress and success of American fish culture. There will be comprised in this exhibit models of the new government floating hatchery, the Sea Hawk, and of the Druid Hill Hatching house in Baltimore.

A great variety of American fish eggs will be shown, and when possible, actual fish culture will be carried on. In addition to this, at the particular request of the German Fishery Commission, there will be sent out a complete series of all the models of fish-ways in use in American rivers. This department will be in charge of Mr. F. Mather. The Government will exhibit in section 7 the various devices of the Lighthouse Board, with all the apparatus used at life-saving stations, and the methods of cautionary signaling. The Coast Survey sends charts, and the deep sea sounding machinery of Mr. A. Agassiz and Captain Sigsbee. The literature of fish and fishing, with all the journals printed in the United States having special reference to these subjects, find their appropriate place. The fine arts will be represented by pictures painted by Mr. S. A. Kilbourne and Walter Brackett. The Messrs. Scribner send their profusely illustrated "The Game Fish of America," by Mr. Goode and Mr. Kilbourne.

A collection of terrapins and live fish were sent in charge of Mr. Mather, by Mr. E. G. Blackford, of this city, who proposes to send every week, during the continuance of the show, an assortment of the leading edible fish to be found in our markets.

MINING IN MAINE.

That gold, silver, copper, lead, and other valuable minerals occurred sparingly in Maine has been known for years; but until within three or four years no one has believed that Maine could ever rank among the mining States. When the geological survey of the State was authorized by the legislature, some forty years ago, the prejudice against mining fevers was so strong that the geologist, Prof. Chas. T. Jackson, was especially forbidden to make known any mineral veins that he might come across. Accordingly, in the official report of the survey, allusion to the precious metals was carefully avoided, though several deposits of promise had been discovered; and since then it has been taken for granted that there were no precious metals in the State, notwithstanding the large number of specimens of silver and copper ores shown in the State cabinet of minerals at Augusta.

During recent years, however, a great many natives of the State have returned from the mining regions of the far West, where they had gained a practical knowledge of mines and minerals; and looking with educated eyes upon the rocks of their native hills they could not mistake the numerous indications of mineral deposits, similar to those they had become acquainted with in California. As soon as one or two mines had given proof of actual bodies of valuable ore within the State the search for paying leads became general. In 1878 nine or ten mining companies were organized and incorporated; during the next twelve months the number was increased to fifty. The Maine mining directory now contains the names of sixty three incorporated companies and thirty four private companies, chiefly devoted to silver mining. If a tenth part of these are based on deposits of real value, and some of them certainly are, the future of Maine as a great mining State is assured. The more promising mineral discoveries have been principally along the coast, in seven belts, which are described at considerable length in the little handbook of the mines of Maine, published last fall by the State Assayer, Mr. Frank L. Bartlett.

The most easterly mining district, the Lubec belt, extends through Campobello Island, Lubec, and Trescott, and probably also to St. George, New Brunswick, where similar deposits have been opened up. The ore consists of silver-bearing galena, zinc, and copper, the proportion of lead and silver increasing downward. Fine specimens of copper pyrites have been found at Campobello Island. Though the oldest mining in the State, the Lubec belt has been but imperfectly prospected.

Further west the Gouldsboro and Sullivan mining belt has been extensively prospected, resulting in the opening of a number of promising mines. It extends from Gouldsboro through the towns of Sullivan and Hancock to Franklin, a distance of twenty miles or more. Similar veins appear in the towns of Cherryfield and Harrington, the ore being a high grade argentiferous galena with zinc blende. At Gouldsboro are several prosperous mines, the ores being abundant and rich. The Sullivan lode is regarded by Mr. Bartlett as one of the most remarkable silver-bearing veins ever discovered. At the surface it showed eight or ten inches of quartz containing silver sulphuret, galena, and iron pyrites. Native silver, in threads and flakes, was obtained at a depth of eight or ten feet. Deeper the predominating ore is a black sulphuret of silver, with specimens of native silver, and a great variety of other silver ores. The proportion of lead is small, there is considerable iron, some arsenic, and a little zinc. A large number of discoveries of ores have been made in the neighborhood of Sullivan and across the river on the Hancock side, and several important mines are being developed. Among the more promising localities are Mount Desert, Hancock Neck, Iron Bound Island, Little Duck Island, and Petit Manan Point.

West of the Sullivan belt, twenty-two miles, is the Blue Hill copper belt, at the head of Blue Hill Bay, in Hancock County. This copper belt is about four miles long by half a mile wide. It resembles the copper belts of Falun, Sweden, the Carpathian belts, and the Chilian deposits. There are six regularly organized companies at work here. A silver mine has been opened at one end of the belt, and ores of manganese and antimony are found in several localities.

Further south, at Byard's Point, in the town of Sedgwick, several silver-bearing veins, one quite large, are being worked. In one place, at a depth of sixty-five feet, native silver was found, the ore possessing many characteristics of the Sullivan ore. On Deer Isle, opposite Byard's Point, a number of promising silver veins are being worked; and other neighboring islands appear to be rich in ores. A large deposit of nickel ore has been found at Vinal Haven.

In the great metalliferous slate belt of Penobscot and Piscataquis counties—70 miles wide by 130 miles long—several mines of copper are being worked, and large bowlders of silver-bearing galena have been found in various places. Several galena mines are in operation in Dexter, Corinna, and St. Albans.

Another narrow but very promising mineral belt is being developed in Acton and Lebanon, York County. The ores consist mainly of argentiferous galenas, with zinc, arsenical iron, and copper. In some places are oxides and carbonates of lead rich in silver. This region has been but little explored.

The Wakefield and Parsonsfield belt crosses into New Hampshire. It is eminently a quartz and gneissic belt, carrying gold and argentiferous galenas. Recent reports tell of an immense vein of auriferous quartz near the State line, in the town of Wakefield. Gold, in quartz and in river sands, has been found in many other parts of the State, but whether in quantities sufficient to pay for mining remains to be seen. Tin has been found in many localities, and may occur in profitable quantities. Zinc ores are abundant, associated with lead, and will probably be profitable as a by-product. There are immense deposits of arsenical iron in the State, which may be made to yield arsenic in abundance. There is a large deposit of antimony at Vanceboro, which has been worked to some extent. Iron, nickel, and cobalt are also said to be abundant.

Altogether the prospect is fair that, after a period of feverish activity, during which much capital is likely to be sunk in ill-considered ventures, the mining interests of Maine will settle down to permanent and profitable work in a sufficient number of localities to give the State an honorable rank among the great mining districts of the world.

THE OLD RIVER BEDS OF CALIFORNIA.

In the current number of the *American Journal of Science and Arts*, Professor Joseph Le Conte discusses the subject of the old river beds of California, which, in several respects, present features that are entirely unique. In most countries, as, for example, in Europe and the Eastern United States, the new or present river beds occupy the same position as the old; while in Middle California the rivers have been *displaced* by lava flows from their former position and compelled to cut entirely new channels.

Again, in certain portions of Europe and the Eastern United States, the old river beds are broad, deep troughs, filled sometimes several hundred feet deep with detritus, into the upper parts of which the present much shrunken streams are cutting their narrower channels on a *higher* level; while in California the displaced rivers have cut their new channels 2,000 to 3,000 feet deep in solid slate, leaving the old detritus-filled channels far up on the dividing ridges. In the Northeastern United States the drainage system has remained substantially unchanged since early tertiary, or even earlier times; while in Middle California the tertiary drainage system seems to have been obliterated, and the streams have been compelled to carve out new and independent drainage systems, to a much deeper level and having the same general direction, but often cutting across the former. Furthermore, in California, the detritus which fills the old river beds is nearly always capped with lava, clearly indicating the cause of the displacement. Finally, the contrast is further marked in the fact that the detritus filling of the old California river beds usually consists of large pebbles and bowlders; while the old channels of the Eastern coast are filled with fine silt.

This peculiar relation of the old to the new river beds does not characterize the whole Pacific slope, but only the auriferous slate belt of Middle California. It is not found in the coast range, nor in the region of the granite axis of the Sierra range. Neither is it found in any marked degree in extreme Northern California, nor in Oregon, nor in Southern California. It seems to be confined mainly to the slate belt of the western slope of the Sierra from Plumas county on the north to Tuolumne county on the south, inclusive, a distance of about 250 miles, and from the San Joaquin and Sacramento plains on the west to about 4,000 feet elevation on the Sierra slope on the east, a breadth of about 35 miles.

There are many difficult and important questions suggested by these phenomena. How were the old river beds filled with detritus? How were the streams displaced? Why have the new channels been cut so much deeper than the old? When did these events occur?

In answer to the first question, Professor Le Conte first points out the fact that rivers either erode or build up by deposit. Every current has a certain amount of energy, and can do a certain amount of work, increasing with the velocity. This energy is divided between the work of transportation and that of erosion. If the load of transported matter be moderate, a large amount of energy is left for erosion; but if it be very great, the whole energy may be expended in transportation and none left for erosion—the limit is reached at which erosion ceases and deposit begins. All that is necessary, therefore, to cause any stream to deposit, is to increase its load beyond the limits of its energy. If rivers build, they almost always do so very rapidly. Now, the phenomena of the old river gravels are precisely those of deposits made by the turbulent action of very swift, shifting, overloaded currents, which must have been far swifter and more heavily loaded than any existing ones. Therefore the process of filling must have been exceptionally rapid. It may have occupied years, or even centuries; but, geologically, it must have been a very speedy process. And these conditions must have been fulfilled by the rapid melting of extensive fields of ice or snow. The reason the detritus was not carried away again was because immediately after the filling the detritus was protected and the rivers displaced by the lava flood. This brings us to the cause of the displacement of the rivers.

Middle California lies on the southern skirt of the great lava flood of the Northwest. The center of the great outflow (which came from fissures and not from craters) was the Cascade and the Blue Mountains. In Oregon the lava is 3,000 feet thick; in extreme Northern California it is still several hundred feet thick, and the old river beds are hopelessly concealed. In Middle California it is reduced by erosion to ridges and patches. Immediately after the obliteration of the previous drainage system, the rivers began cutting a new system having the same general trend (determined, of course, by the mountain slope), but independent of, and therefore often cutting across the older system. From all the facts of the case the conclusion seems inevitable, that the subterranean heat of the impending lava flow was the cause of the rapid melting of the snow and ice, and the consequent rush of the overloaded waters, which filled the channels with detritus. Before the melting was completed the ash eruptions had already commenced, and mud streams, followed by lava streams, completed the work of obliteration.

It is almost certain that, coincident with the outflow of lava in California, there was an increase in the elevation of the Sierra range. The inevitable effect of this would be the cutting of new channels below the level of the old, and thus, finally, the singular relation between the old and the new channels which now exist. Professor Le Conte believes that these general phenomena of the gravels and their accumulation are wholly those of the Quaternary period. They can hardly be explained except by the existence of glacial conditions. Also the gentle movement of elevation which he supposes to have preceded and attended the lava flow is characteristic of the Quaternary everywhere. On the other hand, it is certain that the Pliocene passed insensibly into the glacial epoch, and therefore that glacial conditions commenced in the Pliocene. Furthermore, it is certain that here in California, glacial conditions continued and reached their acme *after the lava flow;* for glaciers occupied all the present cañons, and *swept away all the lavas* from the granite axial region, exposing their roots in the form of dikes. In conclusion, therefore, it seems best to make both the accumulation of the gravels and the lava flow which protected them the dividing line between the Pliocene and Quaternary, although it is probable that glacial conditions had already commenced when these events occurred.

ARIZONA SHELLAC.

At a recent meeting of the California Academy of Sciences Professor Stillman read a paper on the gum and coloring matter found on the *Acacia Greggii* and the *Larrea Mexicana* or creosote plant. The gum which exudes from these plants is very abundant, and is the product known to commerce as shellac. The same plants produce lac dye. Professor Stillman suggested that California might compete with British India in supplying this valuable product. Mr. B. B. Redding said that these lac yielding plants were as plentiful as sage-brush from Southern Utah to New Mexico, and from the Colorado Desert to Western Texas.

The lac is most abundant around stations on the Mojave and Colorado deserts, and exudes as the result of an insect's sting. Calcutta exports a million pounds sterling in value annually of shellac, selling at 25 to 35 cents a pound, and almost as much more of lac dye, selling at 30 to 40 cents a pound. In 1876 the United States imported 700,000 pounds of shellac alone. To collect this is simple work for boys, and will prove an important industry. It will require little or no capital. The twigs are boiled in hot water, and the gum rises to the top, is skimmed off, strained and dried on smooth stones, and hand pressed into flakes, ready to make sealing wax or varnish. The residue, when allowed to settle, makes lac dye. The plants live on a rainfall of three inches a year.

In vol. vi. (Botany) of the Reports of the U. S. Geographical Surveys west of the 100th meridian we find the following information relative to these two plants, which would seem to be worthy the attention of commercial men and manufacturers:

P. 106—ACACIA GREGGII, Gray.—A small tree, 10 to 20 feet high, pubescent or glabrous, unarmed or with scattered stout recurved prickles; pinnæ 2 or 3 pairs, on a slender petiole; leaflets 4 or 5 pairs, oblong or oblong-ovate, 2 or 3 lines long, rounded or truncate above, narrower at base, rather thick, and with 2 or 3 straight nerves, flowers in cylindrical spikes an inch or two long, the peduncles equaling or exceeding the leaves; pods thin, coriaceous, flat, 3 or or 4 inches long by 5 to 7 lines broad, shortly stipulate, acute, curved, glabrous, and reticulated, more or less constricted between the seeds; seeds half an inch long.—From Western Texas to Southern California; collected in Western Arizona, 1872.

P. 41—LARREA MEXICANA, Moricand, *Creosote bush.*—Common from Western Texas to Kern County, California, and southward to Mexico. Dr. Loew's examination proves that the reddish-brown exudate on the branches, caused by an insect, will yield a red coloring matter showing all the reactions of cochineal. "The alcoholic extract of the leaves, on evaporation, yields a greenish-brown residue of a specific and somewhat disagreeable odor, more strongly perceptible on boiling the extract with water This residue is only to a small extent soluble in water, and the solution has an acid reaction. It yields a light yellow precipitate with acetate of lead. The part of the alcoholic extract that is insoluble in water is easily soluble in alkalies. It also dissolves in nitric acid at a moderate heat, whereby oxidation takes place. On addition of water a yellow brittle mass is precipitated." The Mexicans are said to use an infusion of the leaves for bathing in with good effect in rheumatic affections. (Also vol. iii., Wheeler's Reports.)

P. 80—LARREA MEXICANA, Moric (*L. glutinosa*, Engelmann), Valley of the Gila, Arizona.—This shrub is especially common on the hills bordering the Gila, also on the sandy wastes adjacent to Tucson and Camp Lowell, in Arizona, even imparting its strong odor to the air.

In the third volume of these reports this plant is also called stinkweed and etiontio.

The Non-examination of Engineers in Chicago.

Chicago is waking up to the necessity of regulating the employment of engineers and the establishment of a system of official boiler inspection. The *Inter Ocean* says:

"There seems to be an impression that any one, after a few hours' instruction. can run a stationary engine and boiler, or boilers, and the result is that the man or boy who will work cheapest gets the place. Most of the engines in the business and office blocks in the city are in charge of old feeble men or mere boys, and there are actually cases where women do the work. Many of the large factories, rolling mills, blast furnaces, foundries, grain elevators, implement and machine shops have men in charge of the engines, but how competent these men are as engineers there is no means of learning, and boy engineers are to be found even in some of these great establishments. In some places, too, the engineer does not put in his whole time about the engine and boiler, but is called out by the foreman every now and then to do other work, and engine and boiler have to take care of themselves for long periods."

The natural consequence of this sort of carelessness is a frequency of explosions, with loss of life and limb, that is positively alarming. Chicago has no city inspectors of boilers, the only inspections being by the insurance companies where they have risks.

ANOTHER SIX WEEKS OF SUSPENSE.

Five drops of water for the sawing of ten cords of wood is a liberal allowance compared with the originally promised propulsion of steamships across the Atlantic with a pint or so; still it will be an achievement worth recording when it comes off "about six weeks from now." That is the way with Mr. Keely; his marvelous motor is always on the point of being completed, but the finishing touch is always delayed. It is gratifying, however, to know just how the matter stands, and for this information the world is indebted to a correspondent of the New York *Times* who has lately been favored with a "private exhibition" at Mr. Keely's workshop in Philadelphia. The correspondent says of the new engine:

"All the machinery is contained in a cylinder which resembles an ordinary drum. Through this runs a double shaft, one revolving in a sleeve. It is upon this shaft that the difficulty at present exists. The negative and positive motions are nearly equal, and Mr. Keely is engaged in the graduation of these so as to cause them to harmonize. When he accomplishes this, which he says is a tedious operation, then the Keeley motor will be completed."

The *Times* correspondent has seen the machine turn an 18-inch wheel with force enough to break a rope, but he does not say what fraction of a drop of water sufficed to generate the exhibited power. The new generator is pronounced a curiosity. It occupies a space about six feet by ten feet, with a height of five feet.

"There are numerous small pipes, of mysterious appearance, of the thickness of telegraph wire, bored to the fineness of a cambric needle. One of these leads from the generator to the engine, and it is claimed that all the power is secured through this medium, and the regularity of motion secured by the vibratory apparatus contained inside the drum cylinder. People who expect to learn all about the engine, generator, and the secrets of the thing, will probably be discouraged when they take into their mind what Mr. Keely says. "After I have secured my letters patent, it will require at least a year of lecturing to demonstrate the secret of this generator and engine," remarked Mr. Keely. "The apparatus will be in use some twenty years before the thing is fully understood."

The public exhibition of wood-sawing is promised "somewhere about July 1," year not stated. The *Times* correspondent does not say whether he or his friends have any stock to dispose of, or what ground there is for believing that the tedious harmonizing process above mentioned will ever be accomplished. Mr. Keely's facility in the invention of plausible excuses and catch phrases for the gulling of the simple is scarcely less remarkable than the capacity of some people to be gulled.

The East River Bridge.

The New York approach to the East River Bridge is finished with the exception of about four blocks, and the property through to Chatham street has been appraised by the bridge authorities. Should this not be accepted by the owners, a commission, acting under the railroad law, will be appointed to value the land. Upon this portion of the work 90,000 bricks are being laid daily. But one block of the Brooklyn approach remains unfinished. The cities still hold about $1,000,000 of interest accruing from the sale of bonds. The first one hundred tons of the recently awarded contract for steel have been sent from the Cambria Iron Company at Midvale to be rolled; from there they will be taken to the Edgemoor Iron Company, who do the drilling, fitting, etc. The bill for the final appropriation—$2,250,000—now pending in the Legislature, has passed the Senate, with an amendment, and is in the House, where it is favorably received.—*Engineering News.*

International Exhibition of Steam Thrashing Machines.

The Italian Minister of Agriculture, Industry, and Commerce has arranged to hold an international exhibition of steam thrashing machinery at Perugia, in Umbria, Italy, to begin July 1, 1880. Only machines from one to four horse power will be admitted. Four prizes of gold, silver, and bronze will be bestowed by the government. Public tests of the competing machines will be made under the direction of a commission. Applications must be made before May 31st next, to Signor Alessandro Raspi, Secretary of the Agrarian Committee, Perugia, who will furnish any desired information with reference to the competition.

THE enormous advance in the cost of paper may be in part attributed to its extensive use in the various arts and manufactures not connected with printing. The last application of paper is the construction of an astronomical tower twenty-nine feet in diameter at the Polytechnic Institute, Troy, N. Y.

A Prevalent Popular Error.

By the burning of a Chinese wash house in San Francisco a short time since, eleven of the occupants who were asleep in bed lost their lives. The account published in the newspapers described them as exhibiting, by the positions in which their bodies were found, the agony they suffered from the fire. As editors and reporters are considered to possess more than an average amount of intelligence and information, it appears singular that they should propagate or perpetuate such an error. It may be safely asserted as a general rule that persons who lose their lives while sleeping in burning buildings, are suffocated and die painlessly without waking, and before the flames had reached their bodies. The merest tyro knows what would be the effect of going to bed with a pan of burning charcoal in the room, or the effect of blowing out the gas instead of turning it off. An individual going to sleep under such circumstances inhales the impure air, which acts as an anæsthetic and rapidly converts the natural sleep into stupor and coma, from which there is no waking. Persons sleeping in a house which takes fire are smothered in this way by the carboniferous gas long before the fire reaches them. Their bodies or remains are found—not in the halls or stairways where they would have been had they awakened and attempted to escape—but in bed, or in the spot which the bed had occupied, and in the very position in which they had been lying asleep. The exceptions are mostly noticeable, as when persons are seen to make attempts to escape. There is something so horrible in the idea of being burned to death that it were well for the community not to suffer needlessly from sympathy for the victims. To the relatives of persons who lose their lives in burning houses, particularly to parents whose children may die in this way, it may save a lifetime of grief to know that death entered the chamber quietly and performed his task without so much as disturbing the slumbers of his victim.—*Pacific Med. and Surg. Journal.*

NEW USES FOR OLD TIN CANS.

BY A. O. ROBERTS

I give below the result of an extended experience in the utilization of tin cans, such as are used by the million by

Fig. 1. Bird-houses made from Old Cans.

packers of fruits and other articles. These cans, after serving their original purpose, are usually thrown into obscure corners, battered and rusty, a nuisance to every one.

By the method given below these troublesome articles are made useful and even ornamental, such articles as flower-pots, hanging baskets, bird houses, etc., being produced from them with little trouble or expense.

The cans were prepared in the following manner: Procuring a large dishpan, as much asphalt was melted in it as it would hold with safety. Into the boiling asphalt the cans were dipped; as each can was taken out it was rolled in dry sand, to give it a natural ground color; without the sand the effect of the black asphalt coating would be somber and out of keeping with the color of the surroundings. To give some of these bird-houses a still more picturesque effect they were rolled in the ordinary dry packing moss used by florists and wood mosses; also short dry twigs, small cones, and burrs were fastened on the cans. In this way very nice effects of color were produced. It is a well known fact that birds avoid brilliant or artificial colors; for this reason greens, grays, browns, and neutral tints are best for bird-houses. Where cans had been opened so that the top piece was still attached by a small piece of metal, it was bent down so as to form a rest for the birds when feeding their young, or a porch or rain screen over the entrance. All these little points when carried out gave character, variety of form, and completeness. The different ways of fastening and suspending the bird-houses are shown in Fig. 1. I sometimes fastened branches of vines over the birdhouses to more thoroughly obscure them.

A glue-pot, a grater, a fruit gatherer, and a bailer, shown respectively in Figs. 2, 3, 4, and 5. The glue-pot, Fig. 2, was made in the following manner: Selecting an empty two pound can, enough tin was cut away to admit of an empty one pound can. This inner can projected one inch above the top of the one pound can, and was held in position by four wooden pegs, which were slightly tapering, so as to bind. Holes were made in the shoulders of the cans, through which wire bails were fastened.

Fig. 3, a bread grater, is so simple that it hardly needs

Fig. 2.—Glue Pot.

Fig. 3.—Bread Grater.

Fig. 4.—Fruit Gatherer.

describing. Out of a piece of one inch board a holder was shaped on which a perforated piece of tin was fastened. This piece of tin consists of a side of a fruit can flattened out. Lines were then drawn diagonally over it for guides when punching in the holes. The tin was laid on a piece of wood, in which a hole had been made of the exact depth required for the uniform projection of the burred cutters of the grater. The tin was then nailed to one side of the holder and bent over in as perfect a curve as possible to the other side, when it was again fastened.

Fig. 4, a peach gatherer, was made by attaching a circular piece of board to the end of a long pole and fastening to this a can. Inside of the can there was a bag to receive the fruit without bruising. The bag was sewn inside of the can through a circle of small perforations. The rim of the tin was sharpened, so that when pressed against the stem of the fruit it would cut through it.

Fig. 5 shows a liquid measure or a water bailer. A hole is made in a can two inches below the edge; through this hole a handle is inserted which presses against the opposite side and is secured with a nail or screw.

Fig. 6 represents a fruit can converted into a respectable looking flower-pot. The can to be operated on was first dipped in the hot asphalt. A piece of well seasoned white birch bark was cut out of the same height as the can and sufficiently long to reach around it. This piece of bark was so shaped that it flared out from the bottom of the can, leaving considerable space between the can and the bark. This space was filled in with hot asphalt. For ornamentation of the pots burrs of the liquid amber, black alder, and acorns were used. A hole must always be made in the bottom of the pots for the drainage of surplus water.

Fig. 7 is a hanging pot, planted with ferns. This was also covered with white birch bark, fastened on the straight sides of the can with asphalt. Three wires, by which it was suspended, were fastened to the rim of the can. In using cans for flower-pots or hanging baskets care should be taken to thoroughly coat the insides and outsides with the asphalt; this secures the tin from rusting.

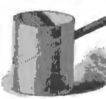


Fig. 5.—Bailer.

Fig. 8, a hanging log, was made by partially telescoping two cans together, after the opened end had been entirely removed. A section of the side of each can was cut out, to leave an opening for the reception of the soil and plants. The cans were then heavily coated with asphalt, particularly where the cans joined, so as to strengthen the joint. Barks of chestnut and oak trees were used for covering the cans.

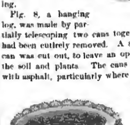


Fig. 6.—Flower-pot.

Fig. 9 is a standard for plants and flowering bulbs. Having secured an old center-table, two cheese-boxes of different sizes were placed one on top of the other, the smaller one on top. Around the side of the lower box fruit can flower-pots were ranged, above these ranged another circle of pots, which stood on top of the largest cheese-box and against the side of the smaller one. On top of the smallest box more pots were placed, so that but little of the cheese boxes could be seen. All the pots were ornamented with burrs, cones, lichens, or barks. The spaces left between the boxes were filled in with wood mosses. Around the rim of the table was nailed hooping from a flower barrel. The inner angle formed by the hooping and the top of the table was patched with putty. Over the entire top of the table, the hooping, and the putty, hot asphalt was applied with a brush. This rendered the top of the table watertight, so that when watering the plants water could not run on to the floor. A hole bored through the top of the table afforded an escape for surplus water. The cheese boxes were coated inside and outside with asphalt, to prevent them from warping. The open space between the first circle of pots and the rim of the table was filled in with earth, on top of which moss was built up to the first circle of pots. The plants used were tradescantia, German ivy, English ivy, vincas, saxifraga, hyacinths, and calla lily.

Fig. 10 shows the complete plant standard. In hanging baskets, pots, and standards, where the plants are planted closely together and in a comparatively small bulk of soil, they require frequent watering and occasional applications of liquid manure. Our fowls provide us with a very fair article of "domestic guano," from which we make good liquid manure of sufficient strength by mixing one shovelful to a barrel of water. Still there is danger in a too generous use of liquid manure; if too strong or too frequently used the tender roots of the plants are injured and the leaves begin to fall.

Fig. 11 is a fern rockery for table or Wardian case. For the rockwork the most picturesque of rocks in form and color were selected. The rocks were fastened together with plaster of Paris, which was mixed with dry colors, grays and browns predominating. As fast as the plaster was applied sand was thrown on it. The effect of the coloring and sanding of the plaster was to destroy its white glaring look, and to harmonize it with the general colors of the rock work. The cans used for the flower pots were first wrapped in wet paper, to increase them in size, before applying the

Fig. 7.—Hanging Flower-pot.

plaster against them when building up the rock work. In a few hours the paper wrappings had so dried that the pots were easily withdrawn, after which the paper was removed and the pots put back in their places.

Fig. 12 is a vase for dried grasses and autumn leaves, which was constructed as follows: To the top of a broken off lamp standard of glass was fastened a fruit can that had been previously dipped in asphalt. The outside of the can was then carefully covered with selected lichens and tufts of "sealing wax moss." Shells and parts of pine cones were used for ornamentation.

Weighing an Elephant without Scales.

An Indian writer relates an interesting anecdote concerning Shajee, the father of the first ruling prince of the Mahrattas of Hindostan, who lived at about the beginning of the seventeenth century. On one occasion a certain high official made a vow that he would distribute to the poor the weight of his own elephant in silver money; but the great difficulty that at first presented itself was the mode of ascertaining what this weight really was; and all the learned and clever men of the court seem to have endeavored in vain to construct a machine of sufficient power to weigh the elephant. At length, continues *Little Folks*, it is said that Shajee came forward, and suggested a plan, which was simple, and yet ingenious in the highest degree. He caused the unwieldy animal to be conducted along a stage, specially made for the purpose by the water side, into a flat-bottomed boat; and then, having marked on the boat the height to which the water reached after the elephant had weighed it down, the latter was taken out, and stones substituted in sufficient quantity to load the boat to the same line. The stones were then taken to the scales, and thus, to the amazement of the court, was ascertained the true weight of the elephant.

The Use of Asphalt and Mineral Bitumen in Engineering Works.*

Adopting the nomenclature of M. Léon Malo, which had received general sanction, the author considered asphalt as

Fig. 8.—Hanging Log.

a combination of carbonate of lime and mineral bitumen produced by natural agency. Asphaltic mastic was the rock ground to powder, and mixed with a certain proportion of bitumen. Gritted asphalt mastic was asphalt mastic to which clean sharp sand had been added. Asphaltic or bituminous concrete was gritted asphalt mastic mixed when hot with dry flint or other stone. Boussingault's analysis of bitumen gave $C_{40}H_{32}O_{6}$. It was, therefore, an oxygenated hydrocarburet, and quite distinct from the preparations of gas tar and pitch which were sometimes erroneously styled bitumens and asphalts. It was important that these distinctions should be borne in mind when specifying asphalte, as their disregard might lead to the employment of a material having few of the properties of the natural rock, although bearing to the uninitiated a strong resemblance thereto. Messrs. Hervé Mangon and Durand-Claye, of the Ecole des Ponts et Chaussées, Paris, had supplied the author with detailed analyses of different kinds of natural asphalts, which were given in the paper, and specimens were exhibited. But beyond knowing the numerical value of the proportionate constituents, it was highly necessary that the engineer should be acquainted with their quality.

Asphalts which gave almost identical analyses might in practice yield widely different results, if the nature of the individual components was dissimilar. Powdered limestone should be white, and soft to the touch; if rough, it probably contained iron pyrites, silicates, crystals, etc. The presence of these substances was prejudicial, and if suspected the limestone should be subjected to a secondary analysis, directions for which were given. The proportion of bitumen to limestone in the natural asphalt should not exceed 10 per cent for carriage ways; indeed, less than that was preferable. For this latter purpose no asphalt should be specified which had not stood the test of at least three hot summers and three cold winters. These precautions being taken, the author was of opinion that a well laid surface of compressed asphalt, 2 inches to 2½ inches thick, on a foundation of

Fig. 9.—Plant Standard, empty.

Portland cement concrete, 6 inches to 9 inches thick, was superior to all other carriage ways. It was noiseless; hygienic, being impervious to urine and the liquids from dung; absorbed vibration; produced neither dust nor mud; was cheap, durable, and easily repaired, and the old materials could be used again. The charge of slipperiness which had been made against asphalt roadways in London was not due to the material, but to the absence of provisions for proper scavenging. In Paris, where the asphalt was regularly scraped, washed, and swept, the complaint did not arise. In support of the assertion that climate did not affect the asphalt in London, a table of humidity was given, showing the means of six years' (1873–8) observations to be: for Paris, 80·2; for London, 81·5. The cost of washing the roadways, when done systematically and on a large scale, was much less than was generally supposed, and the advantages far more than counterbalanced the expense. The author submitted a design for a portable washing and sweeping machine for use in London. Reference was made to the cost of compressed asphalt carriage ways. In Paris this amounted on the average to about 13s. per square yard on lime concrete 4 inches thick, but a thickness of 6 inches to 9 inches of Portland cement concrete was much preferable. The cost of transport of the material also exercised an important influence on the ultimate expense. Details were given of various works of asphalt paving carried out by the author, with particulars of the cost of maintenance.

The quality of absorbing vibration, which was a marked characteristic of asphalt roadways, had been taken advantage of in the application of the material for the foundations of machinery running at high speeds. This was instanced in the case of a Carr's disintegrator, which, being mounted in a pit lined with bituminous concrete, was worked at 500

Fig. 10.—Plant Standard, filled.

revolutions per minute, without sensible tremor, whereas with the former wooden mountings on an ordinary concrete base, the vibration was excessive, and extended over a radius of 25 yards. In the Paris Exhibition of 1878 there was shown a block of bituminous concrete, weighing 45 tons, forming the foundation of a Carr's disintegrator used as a flour mill, and making 1,400 revolutions a minute, a speed which would have been impracticable on an ordinary foundation. Extensive applications of the material for this purpose obtained in France, especially in connection with steam engines and steam hammers.

Another use of asphalt was for the flooring of powder magazines, where its non-spark emitting character made it particularly valuable. It was also largely applied in France, in the form of gritted mastic, for the flooring of casemates in fortifications, and in its pure liquid form for the coating of vaults and arches, where it protected the masonry from damp, and the subsequent disintegration caused by infiltration and by frost.

In conclusion, the author referred to the imitation asphalt occasionally brought forward, and by some regarded with favor on the score of cheapness. The best of these, if properly made, was as dear as the natural material, without in any degree possessing its special qualities of appearance and durability; and in no case were any of them suited as paving materials to resist heavy traffic. In Paris the tricks of irresponsible paving contractors were many, and necessitated constant vigilance. Inferior cement was put into casks bearing established brands, and the concrete made with such cement was put down in thinner layers than was paid for. The author had even known cases where the concrete was omitted altogether, a layer of common mortar taking its place. Such foundations would insure the failure of the best asphalt, which ought to be considered only as a wearing surface or armor to the concrete. But the mode most difficult of detection was the ostentatious display, at the site of the works, of cakes of the particular asphalt specified, while an inferior material was in the boilers. Once laid, wear alone would reveal what had taken place. From these

Fig. 11.—Rockery.

malpractices asphalt had occasionally suffered unmerited condemnation, but the author claimed that with *bona fide* materials and workmanship satisfactory results could always be obtained.

* From a paper by Mr. W. H. Delano, lately read before the Institution of Civil Engineers.

Imitating Watermarks in Paper.

The following method for imitating watermarks is published in a number of the *Obzor Graphitscheski Iskustvo*, which is particularly suitable for designs, etc., in half tones. A plate glass plate, with the edges previously ground, is polished with talc, and the ground edges covered with weak albumen, then coated with collodion; afterward a solution of gelatine, lump sugar, and bichromate is poured on, so as to cover it equally to the thickness of one and one-half mills. When dry, detach, and expose under a negative in the sun.

In the meantime cover a polished zinc plate sparingly with a solution of gelatine in acetic acid containing a grain or two of chrome alum; after drying well, wash in hot water and stand up to drain. Now take the exposed gelatine, dip it into alcohol, and, while wet, squeegee it on to the moist surface of the zinc plate; in a quarter of an hour it is ready to develop and harden, the same as for pigment work. When the relief is thoroughly dry, it is only necessary to lay a sheet of fine paper over it, and pass it through a rolling press, to obtain an exact *facsimile* of the negative.

Our Berlin contemporary for October last contains an example of a similar method to the above executed by Messrs. Werner & Schuman, who have patented the process in Germany under the name of photo-diaphanie.

Herr Meyer has hit upon a plan for producing such watermarks, which is novel in the extreme, and at the same time very simple. A print of the required design, either from a typo-block or an India-rubber stamp, is pulled in a very sticky ink on a sheet of glazed wave paper; over this strew some fine silver sand, and let it dry for a short time, then brush off the superfluous sand, and place a damp sheet of evenly gummed paper carefully over it, and place between the leaves of a letter copying book to dry under pressure. The matrix so obtained can be used on either side, so that if it is placed between two sheets of paper, and the whole run through a rolling press, it will give two very good imitation watermarks. This, of course, has the drawback that

Fig. 12.—Vase.

it is only suited for line work, but, as Herr Meyer justly remarks, it can be used for a variety of purposes, such as drafts, checks, etc.; or any one furnished with a *facsimile* done in the above manner could use it for indorsing bills, etc., by merely passing the same, together with the *facsimile*, through a lithographic or rolling press.

MISCELLANEOUS INVENTIONS.

Veneers made of paper have been used in place of wood veneers to a limited extent. That they have not come into general use is due chiefly to the fact that the oil applied to their grained face prevents the due adhesion of the glue or cement by which they are attached to any wood surface to be ornamented. Mr. Isaiah M. Clark, of Coldwater, Mich., has patented a new, simple, and economical process, producing a paper veneer having an oil grained surface, and which will adhere to any object as firmly as wood veneers.

Mr. D. W. Clark, of Tidioute, Pa., has recently taken a patent for an improvement in window sashes, which all housekeepers will regard with satisfaction. It consists of a very simple arrangement of the sash, by which it may be quickly removed for cleaning, glass setting, or other purposes, and as quickly restored. A dwelling house furnished with these sashes has a positively increased value, for the glass work may be kept in handsome condition with much less labor than heretofore. This is an invention that is needed in almost every household. Considering that it is applicable to every window in every house, it will be seen that the uses of the invention, even in a small town, are quite extensive.

Mr. Allen Cox, of Boston, Mass., has patented a sheet metal pan, made without rivets, wire, or solder, and having its ring secured to it without the use of rivet or solder. It has edges as strong and as durable as the ordinary wire edged pan, is of somewhat less weight, is more convenient, as its broad, flat edges afford a good hold in putting it in or out of an oven. It can be manufactured at a greatly reduced cost of material, time, and labor.

An improvement in library lamp fixtures, patented by Mr. Joseph Kintz, of West Meriden, Conn., consists in a novel construction of clamping rings for holding the shade, and in the manner of fitting the stops that arrest the movement of the lamp in raising it.

Mr. Henry B. Winslow, of Marblehead, Mass., has patented an improvement in apparatus for the manufacture of lampblack. It consists in a certain novel construction, whereby the use of water is dispensed with and the character of the production improved.

A self-locking hook, so constructed that the weight of traces or other tension strain will hold the hooks locked to prevent them from becoming accidentally unhooked, has been patented by Mr. Joel R. Haines, Mount Laurel, N. J. The invention consists in forming upon the shank of the hook a toothed head, a toothed collar placed upon the rounded shank of the hook to engage with the toothed head, and a loop or half link attached to the toothed collar to receive the trace or other article and serve as a guard to prevent the hook from becoming accidentally unhooked.

An improved type clamp, patented by Mr. William J. Adams, of Philadelphia, Pa., consists of four tongued and grooved flat metal bands, each bent at a right angle, so that when fitted together they form an adjustable rectangular frame that may be extended or contracted as required to fit a form of types.

A binding for oil cloths, so constructed as to confine and protect the edge of the oil cloth while allowing the binding to be rolled into a coil, for convenience in handling, storage, transportation, and use, has been patented by Mr. George S. Eaton, of Brooklyn, N. Y. The invention consists in a flexible metallic oil cloth binding, made with a thickened flanged edge to rest against the edge of the oil cloth, and at the same time allow the binding to be wound into a coil.

Messrs. Elias Leak, of Longton, and John Edwards, of Fenton, England, have patented an improved apparatus for supporting pottery ware in kilns and ovens. This invention relates to certain improvements in apparatus for supporting pottery ware in kilns and ovens while being baked, glazed, or otherwise fired, and has especial reference to the seggars in which the ware is placed and supported while in the kiln or oven.

An improved lamp burner, patented by Mr. Orlando Merrill, of Courtland, Ala., is so constructed that wider and narrower wicks and larger and smaller chimneys may be used with the same burners.

Mr. Joseph Kintz, of West Meriden, Conn., has patented an improvement in extension chandeliers, which relates to the means for retaining the extension rod of a chandelier in any position, as drawn out to lengthen the chandelier, and for releasing it, so that the spring may act to draw up the rod. The inventor makes use of a slide rod having its surface grooved or ribbed concentrically and sliding in a collar that is fitted with loose sectional nuts or clamping blocks, which are inclosed within a beveled cup or ring. The cup is moved in one direction by a spring to force the nuts inward and clamp the slide rod, and is fitted for movement by hand to release the nuts by means of a trigger placed in a convenient position operating through a sliding tube that is connected to the cup.

Messrs. Amos A. Deuse and James Deuse, of Chester, Conn., have patented a die for forming double spiral grooves in bits or gimlets, consisting of the two halves having the longitudinal and slightly tapering grooves and diagonal crossbars, one pair of the bars being smaller than the other.

A chop conveyer for millstones, patented by Messrs. James H. Ellis, Alexander Scott, and Eli S. Edmondson, of Goderich, Ontario, Canada, consists in a spiral conveyer fitted to revolve in a channel around the bedstone and below the level of the grinding surfaces, which carries the chop to a discharge spout; also, in the construction and manner of operating the conveyer.

Business Success.

Among the rare bits of wordly wisdom uttered by Major Easthurn, one of the former magnates of State street, whose familiar face and form as he stood at his office door at noon day will be recalled by many, none may be more profitably considered at the present time than his comment on making haste to be rich. "I've stood here on State street," said he, "for forty years, and I have seen men accumulate fortunes by speculation, and I've seen these fortunes disappear. I have seen men go up in worldly wealth, and go down, and I've always noticed that those persons who were content with slow gains and six per cent interest came out ahead in the long run." The greatest of proverbial philosophers has also said, "A faithful man shall abound with blessings but he that maketh haste to be rich shall not be innocent," and again, "He that hasteth to be rich hath an evil eye, and considereth not that poverty shall come upon him." He hastens best who hastens slowly; not lazily, for there must be work, backed by energy, perseverance, intelligent self denial, and thorough business habits. Believers in business impossibilities are not as numerous as formerly. For years we seemed to be living in the atmosphere of venture and great undertakings, and our whole industry was tinged with the unearthly light, but of late years we have been suffering from a collapse of these great hollow ideas, and there is hope for a return of the staple prosperity of earlier times.

The past six years of depression has solidified all branches of business. Prudence and economy is now the motto of the successful merchant. The misfortunes of the past did not come for naught. It is a delusion to suppose that success is attained by any kind of patent process. Books are sometimes advertised with such taking titles as "The Secret of Success," "The Road to Wealth," etc., but they make the path of success no plainer or easier for those who are looking for a short road to wealth, power, honor, and influence. These come only of years of intelligent labor and devotion to business, prudence, economy, honest dealing, courage, and perseverance. He that would have true and lasting success must deserve it. A fortune won by blunder or accident, by short cuts, by strategy, or close bargains is not success, and is likely to leave its possessor as quickly as it came. Success must be conquered in a legitimate way. The man who enters business only for plunder and gain, with no thought of his reputation or character, is not a good business man, and is never regarded by his fellows as a successful man. The truth is that real success does not mean wealth, social position, or political honors alone. To these must be added honesty, a heartfelt consideration for others, civility, promptitude of thought and action, intelligence, sobriety, and every manly virtue.

The truly successful business man is one who is complete in everything that belongs to his calling. He has a thorough knowledge of what has been done in his business, and applies this knowledge with untiring diligence to the undertakings before him. He watches and studies the markets, knowing how much is produced of the commodity in which he deals and the amount consumed; he is prompt in decision and execution, truthful in word and conduct, and keeps his credit unimpaired. In all that he does he commands the respect and confidence of all with whom he deals, and maintains a high and noble character before the world, which is beyond all price. The principal of the "survival of the fittest" is nowhere more applicable than in business matters. The unworthy and incapable are sure in the long run to sink to their proper level.—*American Manufacturer and Exporter.*

How Copyright Differs from Patent Right.

The Supreme Court of the United States has lately given two opinions which illustrate what mistaken notions of copyright are sometimes held by courts, as well as by lawyers and clients. Some years ago Charles Selden, of Cincinnati, published a book entitled "Selden's Condensed Ledger, or Book keeping Simplified." In this book, and in one or two others that he published about the same time, the author explained a new system of book-keeping which he had invented, and gave such directions, specimen pages, headings, etc., as would enable a person to understand and apply the system. Each of these books was duly copyrighted. Selden claimed that his copyright secured to him a monopoly of the system which he had invented, and demanded a royalty for the privilege of using it. The system appears to have been a desirable one, and the royalty was paid by a goodly number of persons, including not a few county auditors. But others made use of it without asking the inventor's permission or paying any royalty, and one person published a book embodying substantially the same method. Litigation resulted, and the question was raised whether Selden's plan or system of book-keeping was protected by the copyright of his books. The Circuit Court of the United States decided that it was. This judgment is now reversed by the Supreme Court, which does not deny that a work on book-keeping may be the subject of a copyright which will prevent the unauthorized copying of the book. But the system or secret of book-keeping described in the book is not a subject of copyright. This is an invention for which protection, if any there be, should be sought under the patent laws. The court drew a distinction between a book as a composition and the art, process, or secret described in it. "A treatise on the composition and use of medicines," says the opinion, "be they old or new, on the construction and use of plows, or watches, or churns, or on the mixture and application of colors for painting or dyeing, or on the mode of drawing lines to produce the effect of perspective, would be the subject of copyright; but no one would contend that the copyright of the treatise would give the exclusive right to the art or manufacture described therein."

In the other case referred to, copyright was claimed in a map of New York city constructed on an original and peculiar plan. Substantially the same plan was used without authority in a map of Philadelphia. The United States Supreme Court, without denying that the unauthorized publication of the map of New York would be piratical, held that the copyright did not protect the mere plan, and hence did not prevent the defendant from making a map of another city on the same plan.—*N. Y. Times.*

A File of Novel Construction.

The *Ironmonger* states that at a recent meeting of the Royal Scottish Society of Arts, Mr. J. Kirkwood, of Edinburgh, described a new file for soft metals and wood. This tool is formed of about 200 pieces of separate steel, connected by an iron bar which is passed through the whole and bound together by a screw. The advantage claimed for the file is that filings of soft metals or wood can be got rid of by simply loosening the screw, and thereby separating the plates, this being done with very little delay or inconvenience. Each file will, it is said, last three years, outwearing 30 dozen ordinary files. The cost of the latter would be 36*l.* and the saving that would be effected by using the new file would be 32*l.* Mr. Kirkwood's file is said to be capable of performing quicker and better work than the cut files in ordinary use.

This file seems to be simply a copy from American patents granted several years ago. For example: J. W. Houston's patent, January 19, 1858, shows a file made as above described; G. B. Cubberley's patent, June 2, 1868, ditto; J. H. Clark, July 5, 1870, ditto. In all of these patents the tool is formed of separate pieces of steel, connected by an iron bar, passed through the whole, bound together by screw, and operated as above mentioned.

British Solidity and Caution.

Our neighbor, the *World*, pungently remarks that if the evidence about the Tay Bridge had been given concerning an American structure which had tumbled down and killed ninety or a hundred persons, would not our esteemed British contemporaries have denounced American fraud and flimsiness? As to the metal used for the columns, moulders employed in the work for twenty-seven years "never saw worse," the coke used for melting it was inferior; holes and cracks were patched up with cement; none of the defective columns, "which were numerous," were broken up, but went into the work, and so on. The most favorable testimony was that of one of the foremen who had been engaged in casting these columns, and he said that the material "was not so terribly bad—for building iron." Not a few witnesses, such as ex-Provost Robertson, of Dundee, an engineer, testified as to the habitual recklessness of the drivers on the bridge. . . . Other habitual travelers gave up the bridge on account of the oscillations and took to the ferry. Altogether the evidence thus far taken seems to indicate such "scamping" in fitting up the bridge and such recklessness in using it as our British brethren have been accustomed to depict as exclusively and characteristically American, and to compare, to our manifest shame and disadvantage, with British solidity and caution.

More New Mines.

The Tucson (Arizona) *Citizen*, of February 7, contains the following: Some exceedingly rich mines have been discovered on the east side of the Graham mountains, in Stockton's Pass, about twenty-two miles from Safford and twelve from Fort Grant. The first locations here were made by B. D. Jones, brother of Senator Jones, and since that time locations have been made by others. The most important claims developed are the Delaware and the Pioneer. The ledge is two and a half to three feet wide, and traceable from 1,800 to 1,900 feet without a break. The assays are $2,300 in silver and $722 in gold. The claims are situated on the north side and in plain sight of the main traveled road. The discoveries have created considerable excitement, and many prospectors are flocking there. One of Jones' mines, the Garibaldi, carries magnificent gold ore, the shining particles being visible in every piece of rock. There is plenty of wood, water, and grass in the vicinity, and a town site has already been located.

A RAILWAY with some novel features has been recently opened between the station of Ribeauvillé (on the Strassburg Basle line) and the town of that name, about 4 kilom. distant. The line is on the road (with which the rails are level), and has a narrow gauge of one meter. There are inclines of forty mm., and curves of fifty meters radius. The train requires only one engineer and one guard. The locomotives weigh nine tons, and among the rolling stock are ten platform wagons, which are arranged for conveying wagons from the main line, without the goods being transferred. These platforms carry two rails, corresponding to the normal larger gauge, and they rest on two bogie trucks, having four wheels each. Thus the larger wagons can be conveyed over the sharpest curves of the narrow line. These platform wagons weigh three tons, and the large wagons, with full charge, weigh fifteen tons, giving a total weight of eighteen tons, which, divided among the four axles, gives a maximum load of only four tons fifty per axle. Passengers, as well as goods, are conveyed on the line. The total cost of the line has not exceeded 250,000 francs.

AMERICAN INDUSTRIES, No. 38.

THE MANUFACTURE OF PRINTING INKS.

On the first page of this paper we illustrate the leading processes of the printing ink manufacture, as conducted by one of the oldest houses in that branch of business. In the early history of printing it was common for printers to make their own inks; but with the more varied requirements of modern printing offices, it has been found that greater economy and generally better results could be obtained by making of this department a separate trade.

The making of first quality printing inks is a nice operation; it requires a high degree of skill and a nicety of judgment obtained only by long experience, although the general methods employed have shown but little change in many years. All practical manufacturers have, however, certain trade secrets, the value of which would be recognized only by an expert, but which they carefully guard, touching details of grinding the color, making the varnish and lampblack, and the various pigments they employ in colored inks.

In our illustrations the view at the upper right hand corner shows the furnaces in which the lampblack is made. This is the color basis of most of the black inks, although finely divided charcoal and occasionally other blacks are also used to some extent. The making of the black is a simple and well understood process, but on the materials employed therefor and the quantity of black used depends much of the success of the ink manufacturer.

The picture to the left at the top, showing the varnish making, presents a part of the business on which, quite as much as the color, depend the distinctness and brilliancy of all first class inks. Linseed oil is largely used for this purpose, though other oils are likewise employed, and resin oil has been extensively used in the cheaper inks. By boiling the fatty constituents of the oil—glycerine, palmitine, etc.—are volatilized. For the best inks, the oil is clarified by digesting for some hours with dilute sulphuric acid at a temperature of 212 degrees, then washing with hot water, when it will dry quickly and thoroughly; the oil is then boiled, and the inflammable vapors that rise are ignited, which, after burning for some time, are extinguished by a cover placed over the vessel. In order to promote quick drying, manganese in its different states and other driers are sometimes added. The view entitled "color plant" shows the department where the various pigments for colored inks are prepared. These are made of almost everything which can be practically worked to give the different shades desired, either mineral, animal, or vegetable, the pigments being prepared so as to be as little liable to change as possible, and then kept on hand to make the basis of the different colors, by taking exact quantities or proportions by weight of each. The coal tar or aniline colors have been very fashionable for some years, and, although they give great brilliancy at first, it has been found they are not lasting.

The black ink making room at the right of the general view shows where the lampblack or other carbonaceous blacks employed are mixed with the hot compound of burnt oil and resin. The mixing is effected in a cylindrical vessel by a revolving shaft with fingers.

The color grinding, as shown in the large view at the bottom of the page, is done by powerful iron or stone mills, in which rollers of great strength, driven by steam power, reduce the mixture to so fine a state that no coarse particles can possibly pass.

Besides the ingredients mentioned above, soap is sometimes used in order to prevent smearing, assist in obtaining sharpness of impression, and help to make the ink leave the types readily when the paper receives the impression. Yellow resin soap, thoroughly dried in slices and reduced to powder, has been considered the best for this purpose.

The qualities which good ink must possess are as various as the widely different uses for which it is employed. Some ink is made to print on dry paper, and some with the sheets wet; highly finished stock requires an ink of different body from that which is to be used on soft paper. All fast printing must have an ink especially adapted for that purpose, and in printing on tinted papers, either with black or colored inks, the best results are only obtained where the ink is made especially for the particular work in hand. The rollers with which the ink is spread over the types must not be injured by any substance in the ink, but the ingredients of the latter should rather be such as will preserve and keep the rollers in good working order. Copper and steel plate printing, and also printing on stone, each require different kinds of ink, and it has been customary with plate printers and lithographers, until within a few years past, to make their own inks. To this department of the business, the firm, since the introduction of steam presses, have given great attention, and their efforts have been attended with conspicuous success, both in black and colored ink.

The making of fine printing inks was first commenced in this country by Mr. George Mather, in 1816. Previous to that time the finer qualities of ink were imported from England and France. This led Mr. Mather, who was a practical printer, to turn his attention to ink making, and after a long series of experiments, he succeeded in making black inks equal to those which had previously been imported. Mr. Mather died in 1861, but the business which he had established and so long conducted was, four years before his death, turned over to two of his sons and his son-in-law, Ralph N. Perlee, who continued it under the firm name of Geo. Mather's Sons. In 1878, Mr. D. W. C. Mather retired from the business, and the present members of the firm consist of S. Talmage Mather and Ralph N. Perlee.

About the time of the retirement of Mr. George Mather from business, color printing was being developed. Mr. Mather had produced, for many years, such colored inks as printers needed for special and immediate use, as shown in the title pages of "Harper's Pictorial Bible," printed in 1847, and other illuminated works, but now a call had risen for stocks of ready-made colored inks, to be kept in store. Consequently, a thorough course of experiments were made chiefly under the directions and personal tests of Mr. Perlee, which were attended with such marked success that the firm obtained the orders for almost the entire amount of letterpress colored inks used during the war for printing the government "greenbacks" and bonds. At this period also, the issue of pictorial papers became a large business, and an entire change in the ink manufacture was necessitated for the production of an article which would be best adapted for the work, and here also Mr. Perlee's efforts were eminently successful. The Picturesque Europe and America the Picturesque World, the Art Journal, and many other works of this character, have been printed with the fine woodcut inks of this firm.

The ink works, as shown in our engraving, are located at Jersey City, and the large establishment now required for the manufacture forms a striking comparison with the limited premises and primitive conveniences which sufficed for the business of the house when it was first established. It is always pleasant, however, in making this record of the development of our leading industries, to note the progress of a long established branch of manufacture, as is shown in the history of ink making by this firm, their factory being the only one which has been in continuous operation for so long a period as sixty-four years.

The New York office of Messrs. John Mather's Sons is located at No. 60 John street.

Safeguards to Human Life.

Mr. T. Blake, M.P., recently addressed a meeting of the electors, in which he took severely to task the administration and the war policy of England in sending an invading army into Zululand. Among other remarks he said: "I regard human life as the most sacred thing. How it is guarded in England! Even if a man has to be put to death, look at the many safeguards there are that his condemnation shall be just, and that the sentence shall be as humanely as possibly carried out. He is first tried, an advocate being provided for him; and if he be condemned there is a minister of religion in the person of the jail chaplain to attend him to give him spiritual counsel and comfort. Everything is done to prepare him for his end, and then on the dread day when he is to suffer the last penalty of the law, the high sheriff—who is a bigger man altogether than the Lord Lieutenant—is there, or some one to represent him, to see that the sentence is carried into effect. What, however, do we do with a man who, instead of having killed only *one* other fellow creature, comes home from the field of battle, having killed *many* men with his own hand or helped in the slaughter of many hundreds or thousands of his fellow creatures? To such men we give titles and distinctions, and we present them with swords of honor. Calcraft, that late public hangman, exercised his office for the government for a number of years. He took the lives of persons condemned to die, and he strove to do his task as expeditiously as possible, so that the suffering should be as short as might be. He did this work of his for many years. But Calcraft received no pension at the end of his official career; he was never presented at court; he was not made privy councillor; they did not even give him a new rope. They give an army officer, whose hand is also red with blood, a new sword. Calcraft, and his successor, Marwood, did their dread work in the name of the law, in the name of the Queen, and in the nation's own appointed way. Why do we hold them in such abhorrence, and yet applaud the man who cruelly takes the lives of his fellowmen, if they are of a different color, who have done no wrong? A man who kills his fellowman is justly regarded as a murderer, while the man who kills 1,000 men, or is the cause of their being killed, is lauded and honored, and is regarded as a great hero. There are some of those officers who have returned from Zululand who exult over the number of Zulus they put to death with their own hands. The men who fight the wars are, it is to be remembered, not the men who make the quarrels. If those who make the quarrels were but to fight them out themselves we should have, I think, but few wars. Everything that adds to the war spirit of the country—as our immense outlay in armaments does—is a national curse. However, I must not dwell too much upon this war policy; but I feel strongly about the sanctity of human life, and that war should be entered upon only as a very last resort. For what, after all, does war determine? Not which part to the quarrel is in the right, but simply which is the stronger. I, therefore," concluded the speaker, "advocate arbitration between nations and the settlement of their quarrels in much the same way that individuals are obliged to settle theirs."

Catching a Cannon Ball.

Recently, at Leeds, John Holtum, a gymnast, was charged before Mr. Bruce, the stipendiary magistrate, with unlawfully wounding Elijah Fenton, a market porter, in the Princess Concert Hall, in that town. Holtum had, during the week, been giving performances showing extraordinary strength in the handling of heavy clubs, cannon balls, etc., and on Friday night he offered a prize of £50 to any person who could catch a ball fired from a cannon as he (Holtum) had done on several consecutive nights. The challenge had been accepted by three men, and a cannon having been placed in position on the stage, a suitable cartridge and a ball weighing seven pounds were rammed home. When Holtum called upon those who had accepted his challenge, Elijah Fenton presented himself, stripped off his coat and waistcoat, and, standing about six yards away from the cannon's mouth, declared that he was ready, and placed his hands in a position to secure the projectile. An attendant fired the cannon, when, to the horror of all present, the ball struck Fenton in the forehead and knocked him down. He managed to crawl off the stage, and at first it was thought that he was not much hurt. Shortly afterward, however, the case assumed a much more serious appearance, and Fenton was removed to the Leeds General Infirmary, where it was found that he had received a compound fracture of the skull, and that his recovery was almost hopeless. The stipendiary magistrate remanded Holtum until Tuesday. Mr. Hobson, the proprietor of the Princess Concert Hall, promised that the performance in question should not be repeated on his premises, but stated that Holtum had been performing on the Continent in this way for five or six years, and never had an accident of this kind before.—*London Times.*

Blistering of Paint and Varnish.

BY FRANK FIELDING.

Many are the opinions expressed regarding blistering, and although some very sensible theories are advanced, we are inclined to believe that the bottom of the subject has never been reached. We hold an opinion of the cause of this trouble, and it may be that this opinion has been forestalled by others, but as we have never seen the points laid down in print, we present them here.

Blistering of a varnished surface after the varnish has had proper time to harden is due to the evaporation of moisture which lies confined under the shell of varnish. This evaporation is caused by heat, and it is seldom, if ever, a blister will rise upon a varnished surface without the temperature is raised to an extreme degree, near to that which the varnish received in its manufacture.

The accumulation of moisture *under* the varnish may be brought about in several ways; the most particular one being in the closing in of moisture in the rough stuff. During the rubbing of the rough stuff the water used is partly absorbed, and unless due care is taken to give ample time for "drying out" before the application of subsequent coats, a great amount of moisture will be confined within the cells of the rough stuff.

Boiled oil contains moisture, as of water, and in cases where steam is used to express the oil from the seed this percentage is increased. Turpentine, an extremely volatile liquid, also forms an evaporating substance which is rendered active by a slight heat, and in its haste to reach the air it disturbs the outer surface, either lifting an elastic coating into bubbles or blisters, or bursting open a hard and inelastic one into cracks.

The primary cause, then, of blistering is moisture either in the form of wet moisture or of evaporating liquids, such as turpentine. The wood may be unseasoned, or it may have been wetted in the course of preparation, such as steaming to bend, etc. The rough stuff water may have been applied before the evaporation of liquids had taken place, either of which would bring about disastrous results.

"Dry blistering" is simply the hasty absorption of the liquids from outer coats by putty or paint which is expressly porous, depriving the coating of the requisite amount of binding and adhesiveness.

To prevent blistering, close up every lurking place for moisture by the use of the A B C system of painting, which will be found to be as easily done as repeating the alphabet. Be careful to have each coat dry before applying another, and you may laugh at the trouble which some of the craft call "deviltries."—*Coach Painter.*

Effect of Intense Cold on Beer.

There are some advantages and many disadvantages to the brewer arising from very cold weather. Beer keeps far better when the thermometer stands below 50° F., but when the thermometer is for days several degrees lower than the freezing point, the usual arrangements for storing beer in this country altogether fail to keep it in good condition. The ordinary cellars, both of breweries, retail establishments, and private houses, are but ill adapted to protecting beer from intense cold, and the result has been apparent during the last few weeks in large quantities of beer either turning up cloudy or failing to drop bright; with a reduction of temperature there is a diminished power of holding albuminous bodies in solution, and therefore some of these separate, producing a cloudiness which requires a long period of high temperature to remove again. Another result of cold weather is to cause beer to turn flat; in its normal and healthy state beer should undergo a slow but regularly secondary fermentation, by which a certain amount of carbonic acid gas is evolved which serves to keep up the "life" of the beer; at very low temperatures the organisms which cause this fermentation are inactive, and no gas being evolved, the beer becomes flat. The greatest danger to beer during the winter months is the sudden changes of temperature; with the thermometer one day at 55° F. and the next at 25° F., it is impossible to keep beer in condition, at least with the usual cellar arrangements which prevail in this country.

THE SAWYER ELECTRIC LIGHT.

The practical working of the Sawyer system of electric lighting was recently exhibited to a few gentlemen in an ordinary up-town residence on West 54th street, in this city. Seven lamps were distributed at convenient points—one in the rear of the hall, one upon the center table as a drop light in the front parlor, two upon a double arm gas fixture of the ordinary pattern in the front parlor, and three in the rear. It is stated that the seven lamps are operated upon one electrical circuit, supplied by a single generator transferring four horse power. The current travels about 1,600 feet through conductors having a diameter of a quarter of an inch.

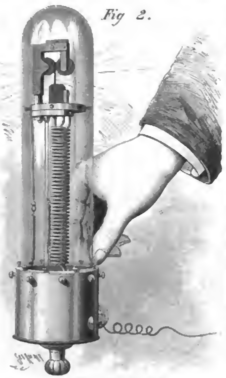


Fig. 2.

THE NEW SAWYER LAMP.

The lamp, based upon the incandescence of a pencil of carbon immersed in nitrogen gas, is in no way different in principle from the Bouliguine or the old Sawyer-Mann lamp exhibited some years ago. The pencil is contained within a globe two inches in diameter and ten inches high, sealed at the bottom by means of a cement, which, while adhering perfectly to the glass and metal, is sufficiently elastic to compensate for the unequal expansion of the two. It softens only at a temperature of 500° Fah. The globes are charged by the process invented some time ago by Thomas B. Stillman, which is so simple in its details and so rapidly operated that a single workman can prepare fifty lamps per hour at a cost of about thirty cents, in such a manner that, according to Stillman's calculation, the amount of atmospheric air remaining is only an infinitely small fraction of the normal quantity.

The large engraving on this page illustrates the manner of filling the lamps with nitrogen gas. Several lamps are placed upon a stand and connected, one with the other, so that the gas that fills the last lamp in the series must pass through all of the others. In this manner the gas is made to do double duty. The nitrogen gas is generated by a process which is not made public. It is stored in gas bags, and when required for use it is forced from the bags by heavy weights through the purifying and drying tubes, A, sodium, B, and bottle, C, whence it is conducted by a flexible tube to the series of lamps on the table, D. The last lamp in the series is provided with a flexible tube dipping in water in the jar, E, to prevent the re-entrance of air to the lamps when the flow of nitrogen is shut off.

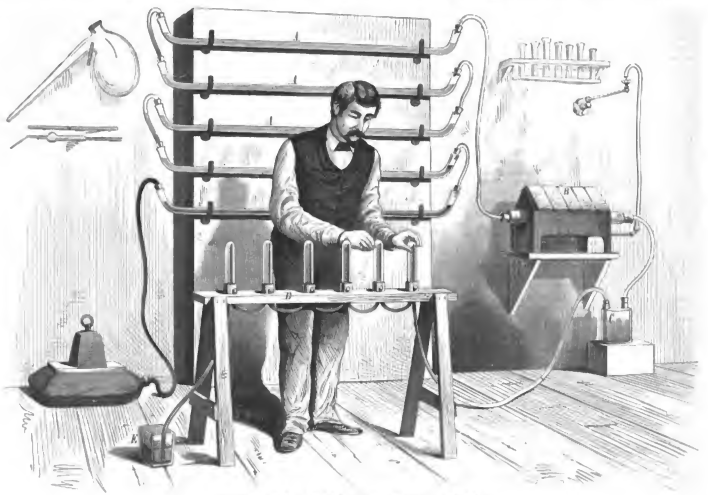
The sodium furnace, B, contains a wrought iron tube partly filled with melted sodium, through which the nitrogen is forced to remove traces of oxygen. The bottle, C, is simply filled with fiber to prevent small particles of sodium oxide from reaching the lamps. The cost of the nitrogen is stated at eight tenths of one cent, and that of its purification as one and one fifth cents; the total cost of recharging a lamp, when the nitrogen is exhausted or becomes mixed with air, being, inclusive of the wages of the workman, two and three fifths cents, against a cost of seventy cents for the process usually employed. The carbon pencil, seven inches in length and about three thirty-seconds of an inch in diameter, is fed upward as fast as disintegration takes place at the point of contact, by means of a regulator, which will be substituted by an automatic feeder as soon as the arrangement can be perfected. Mr. Sawyer says that one of these pencils, used for five hours a day, will last at a minimum calculation from his experiments, not less than ninety days, and, at a maximum, for two years. The cost of the pencil is a trifle less than two cents, and the cost of replacing and recharging with nitrogen nine and three fifths cents. The bag of sodium and the large spiral conductors at the base of the carbon, which were distinguishing features of the Sawyer-Mann lamp exhibited about a year ago at No. 94 Walker-street, have been discarded. Two small steel rods take the place of the latter. The globe, which is not unlike the chimney of an ordinary kerosene lamp in general appearance, is embedded in a nickel-plated base, which may be highly ornamented or not, according to the taste or means of the user.

Photometric tests, it is said, have been made with a Sugg photometer, such as is used by the gas companies for the same purpose, and each light was registered as equal to twenty-seven and five tenths standard candles, or a little more than twice the value of a five-foot gas burner, which usually registers from ten to twelve standard candles.

Mr Sawyer claims that his system of distribution is entirely novel and original, but declines for the present to give a description of it, his patents not having been as yet secured. The regulator, we are told, is based upon the plan used by the old Berlin house of Siemens Brothers, by which only such a volume of current is supplied as is necessary to overcome the resistance. The light is readily toned down to a glimmer by turning a button in the wall. In its optical pro-


Fig. 3

EXHIBITION OF THE SAWYER ELECTRIC LIGHT.



FILLING THE SAWYER LAMPS WITH NITROGEN.

perties this light is much like gas. It is yellow, steady, and soft, and consequently not irritating to the eye. It has none of the blue rays incident to the voltaic arc arrangement, and the shadow cast by intervening objects is softened and mellowed at the margin. For practical purposes it is intended that the power of each lamp shall not exceed that of two ordinary gas jets.

The relative economy of this system of lighting we are unable to learn. "Approximate estimates" of cost make it much cheaper than gas; but in the absence of specific data for exact calculation, such estimates do not go far to satisfy the popular mind.

THE RACINE CANOE.

The pretty little canoe shown in the annexed engraving is the outgrowth of the experience of the Racine Boat Company during the year 1879. It is made of birch, cherry, or cedar, according to the taste of the purchaser. Three sheets of the wood are cemented together with the grain of the inner sheet crossing the grain of the outer sheets, and the whole, while green, is pressed into the desired form under heavy pressure, making a body with but a single seam under the keel. The decks are made in the same way. The ends are nicely sheathed with brass, and the boat is finished with coach varnish, bringing out the beauty of the wood.

THE RACINE CANOE.

The boat thus made is very strong and not liable to injury with ordinary usage. It never leaks, and it is in every respect complete and well finished, and is of the most approved model.

The dimensions of the boat are as follows: Length, 13½ feet; beam 28 inches.

The boat shown in the engraving, when full rigged, weighs but 80 lb.

The parties building this, make open canoes, row boats, and shell boats on the same plan. They are finished with water-proof fillings and varnishes, and are very handsome and desirable. In a canoe similar to the one shown in the engraving, a trip was made late last season from Racine, Wis., to New Orleans, La., a distance of about twelve hundred miles, *via* lake, canal, and river.

Further information may be obtained by addressing the Racine Boat Company, Racine, Wis.

THE FRANKLIN DRAUGHT REGULATOR.

The accompanying engraving represents the well known device in common use for operating a damper in the flue of a steam boiler by steam pressure. This device is substantially the same as that patented by Patrick Clark, in 1854, but it is combined with a recently patented improvement known as the Franklin regulator.

THE FRANKLIN DRAUGHT REGULATOR.

The improvement consists in erecting above the weighted lever, A, a plate, B, from which is suspended any desired number of weights (*a, a', a,*) by rods which are furnished above the plates with thumbscrews, and are forked below so as to straddle the lever, A. The suspension rods and their weights may be so adjusted by the thumbscrews that the lever, when it rises under the pressure of steam, will, after reaching a given height, be loaded by one weight, and after overcoming this load and rising further, will receive another load, a third load being added by another weight after the lever reaches a still greater height.

When there is a slight excess of pressure of steam in the boiler, the lever, instead of being raised far enough to entirely close the damper, as in previous devices of this class, will be arrested in its upward movement by one of the weights, which gives the lever an additional load to carry, and to oppose the excess of pressure, the damper being closed to the limited extent determined by this additional load.

Should the pressure of steam in the boiler be reduced and resume its normal condition, the lever will fall to its original position, the weight will remain suspended clear of the lever, and the damper will be entirely open. If, on the other hand, there should be such an excess of pressure of steam as to raise the lever loaded by the first weight, it will, after rising a short distance, be further loaded with a second weight, and there will be a further contraction of the flue by the damper, a still further rise of the lever, resulting in the arresting of the latter by a third load and a further contraction of the flue.

The manufacturers claim every advantage that is gained by the use of other damper regulators without their disadvantages. In all other machines that have been applied to operate the damper by the action of the steam there are but two possible positions of the damper—it is either wide open or entirely closed; there must be no draught at all, or the full force. This has been the one defect that has prevented them from being thoroughly successful.

By this machine we are now able to absolutely control the working of boilers by keeping the damper always in that position which produces the normal pressure of steam, and by compensating for any rise or fall of pressure due to an irregularity in the use of steam by closing or opening the damper only as may be necessary.

Except in extreme cases, the damper is neither entirely open nor closed, but is maintained accurately in the position necessary to produce a draught corresponding to the normal working pressure.

This regulator is applicable to cases where an artificial draught is used by arranging it to regulate the motor. It must be admitted that economy of fuel is effected by having a constant uniform of draught proportioned nicely by the amount of steam it is desired to carry, which reduces the consumption of fuel to a minimum.

It is impossible for the pressure to run up rapidly, as the increasing pressures are met by a corresponding closing of the damper. In addition to these advantages a great saving of labor is effected, especially where the fireman's duty is not confined to the care of his boilers alone—the steam pressure remains practically always at a constant point, and his time, except when coaling or feeding water, can be utilized in other work.

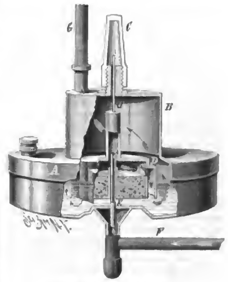
For further information apply to Turl's Iron Works, agents, foot of West 28th street, New York city.

The Alaska Fisheries.

The United States coast-survey schooner Tukan sails from San Francisco, in May, for Alaska, in charge of Mr. Tarleton H. Bean, who has been directed by the Commissioner of Fisheries to make a thorough examination of the character and resources of the Alaska sea and river fisheries.

A NEW GAS ECONOMIZER.

The annexed engraving represents a novel device for enriching and economizing coal gas. It is simple and easily applied, and is said to be very efficient. On the top of the liquid-tight vessel, A, there is a dome, B, from the center of which a glass tube, C, projects. This tube is closed at the top, and at the bottom opens into the vessel, A. A float, D, having a cork bottom, slides upon a tube, E, which enters the vessel, A, at the bottom, and communicates with a pipe, F, leading from the gas meter. In the upper portion of the float there is a shallow chamber which communicates by small perforations with small vertical tubes arranged around



STRONG'S GAS ECONOMIZER.

the float. From the top of the float a needle, *a*, extends upward into the glass tube, C, and serves as an index of the movements of the float. The vessel, A, is provided with a filling tube, through which some of the lighter hydrocarbons are introduced into the vessel. The float rises and falls freely as the depth of the liquid varies in the vessel, but the weight of the float remaining the same its displacement is not affected by the quantity of liquid in the vessel, and the gas ejected into it from the float will always have the same quantity of liquid to rise through, thereby insuring uniformity in both the pressure and the quantity of gas supplied. Gas conveyed to the float through the tube, E, passes into the vertical tubes and rises up through the liquid as indicated by the arrows, and finally passes out through the tube, G, for distribution to the burners.

The gas is enriched by its passage through the hydrocarbon, and the light given by it is correspondingly increased.

This useful invention was recently patented by Mr. George T. Strong, of Port Hope, Ontario, Canada, from whom further information may be obtained.

London Fogs.

The Londoners are, as usual at this season of the year, in great tribulation over their fog. On the theory that the steam from a kettle will disperse fog in a room, a writer in the *Lancet* believes that by sending out an army of steam engines on foggy mornings about the London streets, they might produce a cloudless sky. A most telling prospectus could be made out of the advantages of blue sky over yellow fog. The name of the company, *Capital and Labor* suggests, should be the "Fog Dispersing and Blue Sky Assurance Company," and a copy of the prospectus should be particularly sent to ladies and gentlemen known to suffer from bronchial affections. An army of puffing engines would, of course, be somewhat expensive, and it may be rather irritating to be awakened, say at the hour of 4 A. M., by a chorus of steam engines, but considerations of this kind ought not to be allowed to stand in the way of the realization of an idea which is at least unique.

The Abolition of Labor.

In an extended study of the intellectual and industrial history of mankind (in the new Australian quarterly, the *Victorian Review*), Mr. James Smith says in summing up his conclusions:

In the earlier stages of human progress the race invents, only or chiefly, such implements and machines as are supplements to, or substitutes for, or multiplications of, muscular power. This is the aim or end of mechanism, which replaces manual labor by appliances that relieve the operative, while they increase the production of desirable objects. But as the cerebral development of the higher members of the family of man proceeds, invention takes a loftier flight and finds a wider scope. By giving us the telescope, the microscope, and the spectrum, it extends the power of vision, and endows us with something like another, and with certainly a finer, sense; while the telephone, microphone, and macrophone, are an extension of the faculty of hearing; and looms of every description, sewing machines, organs and pianofortes, type setting and type writing machines, and numerous other inventions of a similar character, may be regarded as an extension of the powers of touch. Ultimately science confers upon us the electric telegraph, which may be said to be an extension of the nervous system of every one of us: inasmuch as the thought which the brain transmits with such startling rapidity to the hand that writes the telegraphic message is transmitted with equal celerity, and by a similar agency, to any part of the world; so that, strictly speaking, the nerve centers of any person in communication with this agency are linked with fibers which cover the entire surface of the civilized globe.

Hence, if I have succeeded in making my meaning clear, the industrial development of the civilized races proceeds, *pari passu*, with their cerebral development. At first man toils laboriously, with nothing to help him in procuring the means of subsistence but the clumsy strength which inheres in his uncouth limbs. Then he constructs a few implements of the rudest and most primitive character. Then he gradually improves upon these, and learns how to forge metal and to fabricate tools. Then he becomes a mechanist; then he arrives at the art of manufacturing labor-saving machinery; then the discovery of the power residing in compressed steam enables him to make enormous strides in every department of industry; and the railroad, the steamship, and the electric telegraph virtually double or treble the term of his natural life, while indefinitely augmenting his strength. And so, as the laureate sings—

> "Through the ages one increasing purpose runs,
> And the thoughts of men are widen'd with the process of the suns."

Meanwhile, owing to the magnitude of the productive forces which are thus brought into active operation, there is an immense augmentation of their material results, and this, we must not omit to observe, is accompanied by a steady decrease in the amount of physical exertion which is necessary to accomplish those results. In the primitive ages of the world, bulk of frame, strength of limb, strenuousness of muscle, and robustness of thew and sinew count for much, both in war and in peace—both with the hunter who subsists by the chase, and with the husbandman who, at a later epoch, tills the ground. But, as the race advances, as the brain grows, and the nervous system is quicker and more sensitive to receive impressions from the outer world and to convey directions to the sensorial organs, and as the five avenues to the mind brighten and expand, mere bulk and muscle subside into minor importance. Manual labor is superseded by mechanical appliances; the artificer rises into an artist; the operative is transformed into the intelligent supervisor of machinery, which effects more in one hour than his unaided hands could have done in a year; and the progress of invention contains within itself the prophecy of the ultimate abolition of toilsome labor, and of its replacement by those "dumb elephants" who work for us day and night, with no other food than a little coal and water, and who are so docile that the hand of a little child can control, regulate, or suspend their movements. Are we not, then, approaching the millennium of the workingman, and drawing near the time when the very phrase itself will have lost the meaning which has so long attached to it, and will be conferred, as a title of honor, upon the real workers of the race—upon men with large and beneficially active brains—statesmen, inventors, teachers, natural philosophers, original thinkers, and all who, marching ahead of their generation, hold up the lamp of progress to enlighten the path of the multitude who follow in their steps?

For some years to come, perhaps, there will be a good deal of rough work, which will have to be done by rough hands: but, in the main, I believe the stream of tendency flows in the direction of emancipating the *élite* of the wages-earning classes from laborious and exhausting toil, and of enabling them to become the superintendents of machinery, emulating, in the perfection of its operation and results, the finest workmanship of human hands.

A Comfort to Fat People.

No doubt, says the London *Lancet*, it is unpleasant to be excessively obese; but the morbid dread of fat which has in recent years become fashionable has no foundation in physiological fact. Fat answers two purposes; it acts as a non-conducting envelope for the body, and protects it from too rapid loss of heat, and it serves as a store of fuel. In the course of exhausting diseases, it not unfrequently happens that the life of a patient may be prolonged until the reserve of fat is exhausted, and then he dies of inanition. Fats supply the material of the heating process on which vitality mainly depends. In great excess it is inconvenient; but the external layings-on-of-fat is no certain measure of the internal development of adipose tissue; much less does a tendency to grow fat imply or even suggest a tendency to what is known as "fatty degeneration." It is time to speak out on this point, as the most absurd notions seem to prevail. Again, it is *not* true that special forms of food determine fat. That is an old and exploded notion. Some organisms will make fat, let them be fed on the leanest and scantiest and least saccharine descriptions of food; while others will not be "fattened" let them feed on the most "fattening" of diets. The matter is one in regard to which it is supremely desirable and politic to be natural, adapting the food taken to the requirements of health rather than substance. Simple food, sufficient exercise, and regular habits, with moderation in the use of stimulants, compose the maxim of a safe and healthy way of life.

Perseverance and Health.

We believe there is a great deal of truth and wisdom in what our excellent contemporary, the *Sanitarian*, says on the above subject: A man who inherits wealth may begin and worry through three score and ten years without any definite object. In driving, in foreign travel, in hunting and fishing, in club houses and society, he may manage to pass away his time; but he will hardly be happy. It seems to be necessary to health that the powers of a man may be trained upon some subject and steadily held there day after day, year after year, while vitality lasts. There may come a time in old age when the fund of vitality will have sunk so low that he can follow no consecutive labor without such a draught upon his forces that sleep cannot restore them. Then, and not before, he should stop work. But so long as a man has vitality to spare upon work it must be used, or it will become a source of grievous, harassing discontent. The man will not know what to do with himself; and when he has reached such a point as that, he is unconsciously digging a grave for himself, and fashioning his own coffin.

Life needs a steady channel to run in—regular habits of work and of sleep. It needs a steady, stimulating aim—a tend toward something. An aimless life can never be happy, or, for a long period, healthy. Said a rich lady to a gentleman still laboring beyond his needs: "Don't stop; keep at it." The words that were in her heart were: "If my husband had not stopped, he would be alive to-day." And what she thought was doubtless true. A greater shock can hardly befall a man who has been active than that which he experiences when, having relinquished his pursuits, he finds unused time and unused vitality hanging upon his idle hands and mind. The current of his life is thus thrown into eddies, or settled into a sluggish pool, and he begins to die.

Injurious Effects from Vulcanite Plates.

Samuel Sexton, M.D., in an article published in the *American Journal of the Medical Sciences*, for January, 1880, states that vulcanite plates produce diseases that are more frequently the source of reflex aural disease than any others worn. They have been in use for over twenty years, and their adoption is very general. The constituents of this are caoutchouc, the sulphur required in the vulcanizing process, and vermilion or the sulphide of mercury, used for the color it imparts. The quantity of the latter ingredient is believed to be equal in weight to both the other substances mentioned; accurate knowledge, however, is withheld by the manufacturers.

The gradual disintegration of these plates, as they are worn in the mouth, liberates a salt of mercury whose poisonous effects are well known. But besides yielding a poison, they are otherwise injurious to health. Inquiries from dentists elicit the fact that at least one third of all those who attempt to wear them experience great irritation of the mouth, an irritation that is frequently accompanied by hypersecretion of the buccal fluid. The sufferer usually lays aside the plate until informed of the necessity of becoming accustomed to its presence by uninterrupted use. Vulcanite is a non-conductor of heat, and the effect of its contact with the highly sensitive tissues of the mouth is to produce hyperæmia and inflammation. Another source of injury is the very close contact of these plates, which is maintained by atmospheric pressure, and may favor the absorption of their substance.

Dirt and Bodily Heat.

The part which the skin plays in the regulation of bodily heat is not adequately estimated. The envelope of complicated structure and vital function which covers the body, and which nature has destined to perform a large share of the labor of health preserving, is practically thrown out of use by our habit of loading it with clothes. It is needless to complicate matters by allowing it to be choked and encumbered with dirt. If the skin of an animal be coated with an impervious varnish, death must ensue. A covering of dirt is only less inimical to life. We are not now speaking of dirt such as offends the sense of decency, but of those accumulations of exuded matter with which the skin most become loaded if it is habitually covered and not thoroughly cleansed. The cold bath is *not* a cleansing agent. A man may bathe daily and use his bath towel even roughly, but remain as dirty to all practical intents as though he eschewed cleanliness; indeed the physical evil of dirt is more likely to ensue, because if wholly neglected, the skin would cast off its excrementitious matter by periodic perspirations with desquamation of the cuticle. Nothing but a frequent washing in water, of at least equal temperature with the skin, and soap can insure a free and healthy surface. The feet require especial care, and it is too much the practice to neglect them. The omission of daily washings with soap and the wearing of foot coverings so tight as to compress the blood-vessels and retard the circulation of the blood through the extremities, are the most common causes of cold feet. The remedy is obvious: dress loosely and wash frequently.—*Lancet.*

Gas and Electricity.

In his recent inaugural address before the Society of Telegraph Engineers, London, President W. H. Preece said:

The electric light has been making considerable progress, and is gradually forcing itself into practical use, in spite of many of the drawbacks to its employment that have yet to be removed. The lamp of the future has not yet been produced, though steadiness and duration have very much advanced during the past twelve months. There is very little room for improvement in the generating machine, for both the Siemens and Gramme machines convert about 90 per cent of the energy thrown into them into electric currents, and this is a duty which no other kind of machine can show.

One of its most notable and useful applications has been on board ship, to further the operations during the night in laying and repairing cables. I was present on board the steamship Dacia, in the Mediterranean, when this was done, and the success was unequivocal.

The Brush machine has recently been introduced into this country, and its performances are certainly wonderful. It produces an electromotive force of over 800 volts, and I have seen it maintain 20 very steady arcs joined in series. 16 appear to be its efficient limit, and this number of lamps, giving over 1,000 candle power, are easily maintained by an expenditure of 13½ horse power. The performances of the Brush light are certainly the most advanced form the electric light has yet taken. There are over 800 of these lights in the United States; and it is worthy of notice that it has quietly crept into existence without the aid of the ubiquitous and omniscient newspaper correspondent, or the transmission of any sensational telegrams, to the detriment and discomfort of gas shareholders.

It is assumed by many that the electric light is devoid of heat, but Professor Dewar has shown that a Siemens arc radiates heat equivalent to 3 horse power per minute. Moreover, the use of such powerful currents, unless carefully directed, are dangerous to life and limb, and may even, unless properly protected, result in fire.

Gas is not going to be affected by the electric light. The proper function of gas is to generate heat. 94 per cent of the ingredients of gas are consumed in generating heat, and only 6 per cent in producing light. It is remarkable that so amenable and tractable an agent for heating purposes has not been more utilized, but the fact is that the public is ignorant of its properties, careless of its employment, and callous of its defects. It is not too much to say that 50 per cent of the gas manufactured is absolutely wasted for illuminating purposes by the wild extravagance with which it is burnt, and by the want of those systems of regulation which have been introduced to compensate for irregularities and excesses of pressure.

Feather Plush.

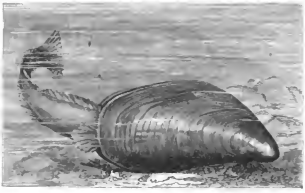
For some time past the ingenuity of several manufacturers has alighted upon the idea of utilizing feathers as a material for weaving fabrics in various ways. We thus saw recently two samples of feather cloth which had come from France, and which consisted, apparently, of the down of feathers interwoven with fine woolen warp, in one case throwing the feathers to one surface, and in the other laying them upon both sides; the latter, especially, was a very interesting and exceedingly light cloth, which we understand is used in France for chest protectors, and is for that purpose more agreeable, though perhaps not so durable, as flannel or felt.

From a foreign patent we see that one manufacturer has protected a machine by means of which he produces a cloth or felt, in which he mixes finely broken feathers with wool, and then cards and felts them together. The machine he uses for the purpose is a combination of the opener and scutcher as used in cotton mills, and the fur formers employed in hat works. The feathers, which may be of any cheap kind, are placed upon a feed table, whence they pass under a drum set laterally with steel knives, which break the feathers; from this drum they pass between three small rollers and a superposed fluted and chased iron roller with a to-and-fro motion endways, as well as a revolving motion, and by which the reduced feathers are ground quite small, and, falling upon a traveling apron, pass on to a spiked drum running in a cage, whose office is to reduce any pieces which have escaped the action of the rollers. The pounded feathers fall to the bottom of the machine, whence a fan sends them into a proper receptacle, where the feathers are mixed at once with wool. They may be blown direct upon the card table of a carding engine, which, in that case, must have a cover as is usual in carding cotton.

The mixture of feathers and wool can, of course, be made in any proportion. The inventor states that he has obtained the best results by felting the cloth; the laps made by the carding engines are jointed by friction under the influence of steam, then milled, dried, and subjected to the action of steam at a high temperature in a steam chamber, which latter action is said to thoroughly amalgamate the feathers and the wool.—*Textile Manufacturer.*

CURIOUS CAPTURE BY AN OYSTER AND A MUSSEL.

A correspondent of *Land and Water* lately forwarded to the editor of that journal a box containing a shanny and a mussel, which he describes as having been taken in the harbor at Looe, Cornwall, in exactly the position represented in the accompanying illustration. The shanny and mussel were taken by a fisherman who was gathering mussels for bait at Looe. Mussels are found in great numbers at the bottom of the harbor there, and the fishermen use a long-handled, four-pronged fork for catching them. A boat is moored over the spot on which the mussels are to be found, and the fork is employed to bring them from below into the boat. In the case in question the shanny and mussel were brought up as shown in our illustration. The fish was alive when taken, and its head firmly fixed in the mussel. This certainly may be considered a curious capture, and from the evidence it may be fairly assumed that the shanny, seeing a tempting mussel with its mouth open, was induced to pop his head in—an operation which the mussel doubtless resented by immediately closing its valves, retaining the fish in its deadly grasp.

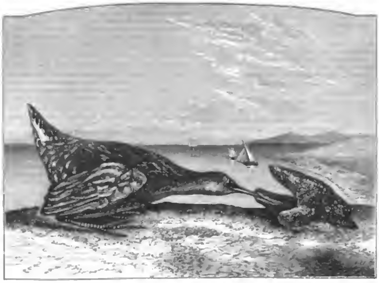


SHANNY CAUGHT BY MUSSEL.

In the same periodical some time ago was recorded an even more extraordinary capture than the above, by Mr. Frank Buckland. We reproduce Mr. Buckland's remarks and the illustration which appeared at the time:

"Some time since, when examining the famous oyster beds at Helston, near Falmouth, Mr. Fred Hill, of Helston, was kind enough to accompany me and my friend Mr. Howard Fox, of Falmouth, in our expedition. Mr. Hill mentioned to me at the time that he had a curious specimen of a bird that had been caught by an oyster. The bird and oyster had been mounted in a case by Mr. Vingor, of Penzance. I have received from Mr. Hill a photograph of the event, which I have since had engraved. The history is that a woman who sells oysters went one morning to the Helford river and found the bird—a common rail—quite dead, with its beak held quite firmly by the oyster, which was still alive.

"The bird in all probability was wandering along the foreshore, looking for his dinner, and the oyster—possibly left longer by the tide than usual—was opening his shells waiting the incoming water. The hungry rail, seeing something that looked like a white and dainty bit of food, pecked at the body of the oyster, and probably pricked him sharply with his beak. The oyster then snapped his shells together as quick as a rat trap, and the poor bird instantly became a prisoner to die (or possibly get drowned as the tide rose) in his prison.



RAIL CAUGHT BY OYSTER.

The History of Chalk Flints.

At a recent meeting of the Geological Society (England) a paper was read by Dr. Wallich, describing the origin, mode of formation, and causes of the stratification of the flints which occur in chalk. Taking as the basis of his conclusions the fact brought to notice by him in 1860, namely, that the whole of the protozoan life at the sea bed is strictly limited to the immediate surface layer of the muddy deposits, he pointed out in detail the successive stages of the flint formation, from the period when the chief portion of the silica of which they are composed was eliminated from the ocean water by the deep sea sponges, to the period when it became consolidated in layers or sheets conforming to the stratification of the chalk. In relation to this subject the author claimed to have sustained the following conclusions: 1. That the silica of flints is derived mainly from the sponge beds and sponge fields which exist in immense profusion over the areas occupied by the Globigerine or calcareous "ooze." 2. That the deep sea sponges, with their environment of protoplasmic matter, constitute by far the most important and essential factors in the production and stratification of the flints. 3. That, whereas nearly the whole of the carbonate of lime, derived partly from foraminiferan and other organisms that have lived and died at the bottom, and partly from such as have subsided to the bottom only after death, goes to build up the calcareous stratum, nearly the whole of the silica, whether derived from the deep sea sponges or from surface protozoa, goes to form the flints. 4. That the sponges are the only really important contributors to the flint formation that live and die at the sea bed. 5. That the flints are just as much an organic product as the chalk itself. 6. That the stratification of the flint is the immediate result of all sessile protozoan life being confined to the superficial layer of the muddy deposits. 7. That the substance which received the name of "Bathybius," and was declared to be an independent living moneron, is, in reality, sponge protoplasm. 8. That no valid *lithological* distinction exists between the chalk and the calcareous mud of the Atlantic; and *pro tanto*, therefore, the calcareous mud may be, and in all probability is, a continuation of the chalk formation.

Telegraph Wires "Crossed" by Magpies.

The *Journal of the Melbourne Telegraph Electrical Society* reports a curious case of interruption which occurred recently on two of the Western lines, Australia. An intermittent "cross" (one of the most troublesome faults to detect) existed for some little time on these lines, and a close inspection was found to be necessary. This resulted in the discovery that some magpies (Australian) had actually built a nest on one of the telegraph poles, and, among other materials used in its construction, had taken all the odd pieces of the wire which they could find within some distance of the spot; scraps which had been thrown aside by the line repairers were twisted up together in the most singular manner, considering that they had no pliers to work with excepting their beaks. Some of these pieces of wire touched one line, and some occasionally the other, causing the "cross" complained of. It appears that lately several attempts at nest building on the part of magpies on the telegraph poles on the plains in the Western District have been discovered.

The International Postage Stamp.

The *Annales Industrielles* says that France and Belgium are now making negotiations in regard to an international postage stamp. If the project is realized the payment of small sums might be made in stamps. If the plan could be made universal not only could such sums be sent from one country in payment of amounts too small to send by postal order, but stamps could be sent to prepay answers to letters, which at present is impossible.

Growth of Plants.

The free evening lecture at the Working Men's College, Great Ormond street, London, on February 21, was given by Mr. Francis Darwin, M.D., a son of the well known naturalist. The growth of a plant, the lecturer said, might be likened to the growth of a snowball set rolling down a snow-covered hillside. Both plant and snowball grew in size by the addition of matter; but while, if the bulb of a hyacinth were placed in water and kept in the dark, it would grow in the ordinary sense of the word, in reality the plant would merely have taken stuff out of the bulb and arranged it in a different way, whereas in the growth of an oak tree from an acorn a quantity of new stuff was formed. These instances of growth suggested the questions, first, how a bulb or bean rearranged its matter in forming a plant, and, secondly, how all the new material was obtained that went to form a tree? He intended on that occasion to speak of only one half of the question: How the plant in growing arranged its material? First, it was necessary to know what a plant was made of. If 100 lb. weight of some growing plant were taken, say turnips, and the water driven off by drying, it will be found that the weight would have decreased by 90 lb., and that the solid, woody part remaining, about 10 lb. in weight, would nearly all burn away, leaving but a few ashes. In order to give some idea of the way in which this large quantity of water was held in the plant, Dr. Darwin compared the effect of water on dead matter, such as tea leaves or leather, with the effect of giving water to a growing plant—the stiff, dry tea leaves became limp and soft, while the drooping, flaccid stem of a living plant, when watered, became stiff and elastic. How could the plant build up a bright, stiff stem with so much of so unstable a material as water, and how did the water become a source of strength to the plant? To understand this they must know how the water was contained in the plant. The solid material was formed into little cavities, and these—an infinite number of little boxes, as it might be—were filled with water. The way in which the water might become a source of strength could be seen by forcing water into a flexible tube or bladder, or by blowing air into an empty glove. The pressure of the water contained within caused the walls of the cells to become stiff. There were other ways, too, in which this stiffness was obtained, the water getting into the texture of the woody stuff and stiffening it as water stiffened sailcloth. This state of things existed also in the pith, and each cell, being over-filled with water, was for ever trying to lengthen itself. Some of the results of these conditions in the plant were then explained by the use of two pieces of spiral spring, and for a more familiar example the audience were referred to the effect of splitting a dandelion stem. Each half curled over outward because the more elastic pith, trying to lengthen itself, was prevented from expanding on one side by the less elastic bark. With two pieces of spiral spring in a linen tube it was next explained how, when the pressure of water in the cells in the two halves of the pith was not equal, the stem did not grow straight. Not that plants bent accidentally or in a purposeless manner. On the contrary, when the plant bent it was with some distinct and useful object. To the explanation of this point, the rest of the lecture was directed. The directions and forms which the root and stem of a young growing plant might take were happily illustrated with a piece of whitened lead pipe of small bore put through a cork, which did duty for the bean. A great many theories had been offered to account for the fact that the root always tried to grow towards, and the stem away from the center of earth. Having related Andrew Knight's ingenious experiment with a revolving wheel, by which, with centrifugal force as a substitute for gravity, the plant was deceived and the direction of growth in seedlings was changed, the lecturer next dealt with the influence of light and damp on the growth of a plant. The stem was invariably shot out or bent aside in order to get at the light; and the root, with equal persistency and certainty, was sent to find moisture. It would have been noticed, Mr. Darwin said in conclusion, that he had, throughout, spoken of plants perceiving the light, and knowing where the center of the earth was, and had used other expressions of a similar kind, usually only applied to animals. He had done so with no idea of being paradoxical, but because he thought that by thinking of plants in this way we were more likely to learn what was going on within them. If we would understand the actions of an animal, we must know what was useful or not useful for that life, and it was quite as necessary to consider in the life of a plant of what use its actions were, and, in a certain sense, why it acted in a particular way.

ADVANCE IN THE PRICE OF DIRT.—In consequence of the rise in the prices of rags and other fibers, the price of South Carolina clay, used by paper makers to increase the weight of their goods, has lately been advanced two dollars per ton.

Business and Personal.

NEW BOOKS AND PUBLICATIONS.

Directory of the Flour Mill Owners and Millwrights of the United States and Canada, 1880. Milwaukee, Wis.: E. Harrison Cawker, editor *U. S. Miller.*

Business men having or desiring trade with millers and millwrights will appreciate the value of a list of names with post office addresses covering so fully the great flouring industry. The book shows a marked improvement on the former directory in size and fullness of information.

Anuario Universal. Almanque Estadistico, Administrativo y Comercial para 1880. Mexico: Filomento Mata, editor. 32mo, cloth, pp. 408.

Well filled with information in relation to the governmental, social, and commercial affairs of the State of Mexico, with a plan of the capital etc.

Sewers and Drains for Populous Districts; with Rules and Formulæ for the Determination of their Dimensions under all Circumstances. By Julius W. Adams. Illustrated. New York: D. Van Nostrand. 8vo. cloth, pp. 228.

In 1857 Mr. Adams was charged with the planning of the sewage system of the city of Brooklyn, covering an area of twenty square miles; and as chief engineer of the Board of City Works he has taken a controlling part in the development of the great work. The constant inquiry for detailed information in regard to the system pursued has led to the preparation of this volume, in which he lays down the principles and describes the methods which he believes to be best adapted to the economical and successful sewering of towns and cities. The work is eminently practical and to the point.

Saws: the History, Development, Action, Classification, and Comparison of Saws of all Kinds. By Robert Grimshaw, Ph. D. Philadelphia: Claxton, Remsen & Haffelfinger. Quarto, cloth, pp. 100. Price $2.50.

Reserving sawing machines for another treatise, Mr. Grimshaw here describes with great fullness and with a profusion of illustrations, the saw blade, in all its varieties. The manufacture of saws and the various processes of setting, swaging, gumming, and filing of saws and related matters are treated in appendices which contain also many useful tables of gauges, for measurements, etc., and an alphabetical list of all United States saw patents from 1790 to 1880. The book is handsomely made and well indexed.

Free Ships. By John Codman. New York: G. P. Putnam's Sons. Pp. 54, paper, Price 25 cents.

Second edition of No. VI. of Putnam's Economic Monographs. Adds to the original arguments for the restoration of the American carrying trade by the free importation of ships, a review of the plans of Senator Blaine and Secretary Sherman.

A Manual of Tobacco Culture. By R. B. Davis. Hickory, North Carolina: Hall Brothers. Paper, pp. 30. Gratis.

Sets forth the advantages of the Piedmont section of North Carolina for the production of yellow tobacco, and treats the cultivation and curing of the tobacco plant with special reference to the condition and requirements of Piedmont.

Sawyer's Hand Book.

Emerson Smith & Co., extensive saw manufacturers at Beaver Falls, Pa., have issued an attractive hand book, in which they not only tell the public where to purchase saws, but the book also contains many useful hints on saw mills and machinery, how to straighten saws, their proper speed, prevention of heating, etc.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the Scientific American Supplement referred to in these columns may be had at this office. Price 10 cents each.

(1) W. E. asks: Is the apex of the zodiacal light in the same direction from the sun as the aphelion point of the earth's orbit? A. The zodiacal light extends out on each side of the sun nearly in the plane of the ecliptic.

(2) W. B. asks: 1. Is there an odorless coal oil in the market? A. No. 2. What chemical will dissolve old rubber boots? A. There is no practical solvent. See pp. 49 and 100, Vol. 20 Scientific American.

(3) F. A. P. asks: Is there anything that printers use to put in their ink, vermilion, lake or black, for instance, which will give a lasting gloss? If so, what is it and how is it used? A. Use a fine, well milled ink. We know of nothing that will impart greater gloss to ink used in type work.

(4) L. F. T. asks how to make an imitation of ground glass by the use of acids or some inexpensive material other than machinery. A. The sand blast or wheel is the cheapest method of frosting glass. The only acid that can practically be applied is hydrofluoric, produced by the action of warm sulphuric acid on powdered fluorspar. Hydrofluoric acid in gutta-percha bottles is quoted at $2.50 a pound in New York.

(5) A. J. P. writes: I wish for some process of duplicating writing by which I may secure more copies—say 100—and more distinct than by the new gelatine pad process; also an apparatus not so expensive as the electric pen or the papyrograph, which cost, I believe, $35 or $40. I wish something as cheap as the first, and effective as the last. I see no reason why the latter might not be afforded for $5.00. A. Try the following: Use the gelatine pad made with a large proportion of glue. Soak writing paper in alum water to saturation and dry carefully. Write with any ink on the prepared paper and use as in the gelatine pad process; the parts of the gelatine surface not protected by the ink will be affected by the alum so as to leave a stencil which can be used by inking with a roller as in the electric pen process.

(6) S. A. asks (1) whether it is advisable to build a cistern under the basement of a dwelling house. The architect of the building insists that it should be under the building; other parties contend that it will prove injurious to the health of the inmates, on account of condensed air in cistern. We would like your opinion on the subject. A. We do not advise placing the cistern under the house as proposed. 2. What are the proportions of the best concrete? A. 5 parts gravel or sharp sand, 1 part ground quicklime (fresh). Mix with a shovel, and slake with water into a thick mortar.

(7) R. G. asks: 1. Does the velocity of a projectile from a gun outside the gun ever exceed the highest velocity inside the gun? A. No. 2. Or another phase of the same principle: does a ball thrown from the hand ever travel more rapidly than the hand in throwing it? A. Possibly yes, as the muscles of the fingers give an impulse to the ball.

(8) E. L. K. asks if there is a mixture of any kind that will remove old paint from wagon bodies? A. There is no mixture that will remove the paint successfully and leave the wood in good condition to repaint. It is a better plan to soften the paint by heat from a hot iron, or alcohol or gas flame held near it, and then scrape it off with a suitable knife or chisel.

(9) W. R. H. asks: 1. Should steel for permanent magnets be hardened? If so, what temper is best? A. The steel should be hardened and drawn to a deep yellow. 2. Where can I find information on minute details of construction of both permanent and electro-magnets? A. In Supplements 142, Telephones; and 182, Electromagnets.

(10) F. E. G. asks (1) for dimensions for a boiler of an engine 1 inch by 2 inches. A. About six square feet heating surface. 2. What should be the thickness of plates of copper and iron for such a boiler? A. Thickness depends upon diameter of the boiler. 3. What would be pressure to the square inch to raise a valve ¼ inch in diameter and center of valve 1 inch from fulcrum, and lever 6 inches long, and weight 3 lb. on end? A. 366 lb. per square inch nearly.

(11) F. W. S. asks if there is any method of deadening the noise of presses by any substance that could be placed under the feet of the machines. I run two presses, an 8 Gordon and an Acme cylinder, in the second story of a brick building, and the jar and noise is annoying to tenants on the floor underneath. A. We think if the frames of the presses were set on pieces of thick india rubber, and the floor deadened in any of the usual modes, the presses would cease to be a nuisance.

(12) R. K. asks: When does a stationary engine run backward or forward, or, in other words, which way does an engine run when the balance wheel runs from the cylinder or power? A. If the top of the balance wheel runs from the cylinder, the engine runs forward.

(13) W. R. W. asks: 1. When and where was the ship known as the Three Brothers (formerly the Vanderbilt) built, and who was her first captain? A. 1856, at Greenpoint, L. I., Captain Le Fevre. 2. What is her tonnage, and is she the largest sailing vessel now existing? A. 3,360 tons; the largest American sailing ship, but we believe there is a larger English ship.

(14) W. T. asks: 1. Can I separate the albumen from ordinarily albumenized paper after a photo has been printed on it, so as to leave a temporary film, to be fixed to glass? If so, how? A. We know of no satisfactory way of doing this. Try the following: Slightly coat the face with a thin negative varnish, press the print down smoothly on the glass, and, when the varnish has hardened, thoroughly moisten the paper with hot water and carefully detach the paper. A little ammonia may be used with the water. It is better to print the photograph directly on the gelatin coated glass. 2. What colors would I use (water or oil) for lantern slides? What pigment and how mixed? A. The available pigments are Prussian blue, gamboge, carmine, verdigris, madder brown, indigo, crimson lake, raw and burnt sienna, cappah brown, and vandyke brown. The aniline or coal tar dyes are also used, but, unfortunately, they are apt to fade. No particular method of mixing the colors is requisite; ordinary oil or water colors will do, but they must be ground extremely fine. The pencils must be small, and their points unexceptionable. Camel's hair is preferable. The best vehicle to use for thinning out the colors is ordinary megilp, and the smallest possible quantity only of this should be used; if excess is used, the colors will run. The best medium for laying on the first wash of color is a hot solution of isinglass. If the lime light is to be used the colors should approximate as nearly as possible to nature. Lamp and ordinary gas light is deficient in blue, the yellow preponderating; where these are used the tints must be arranged accordingly; greens must be bluer than natural, yellows inclined to orange, and all shades of violet eschewed. Consult Groom's "Transparent Printing on Glass." 3. How are the sheets of paper prepared for ordinary transfers, and what is the dull film on the face side? A. The pictures are printed on paper heavily sized with gum, the face being also gummed.

(15) J. A. E. asks: How can the rattling or bubbling of a kitchen or hot water boiler be prevented or remedied? I have one that is piped with ¾ inch pipe, with 8 feet of pipe in the stove, with three return bends. A. When a coil is used in a stove instead of a water-back, the diameter of the pipe should not exceed a certain proportion to its length, with the fewest possible turns, that the water as it warms can pass rapidly to the tank or boiler, and not be retained long enough in the coil to form steam or to get nearly as hot as it is possible, consequent with the pressure. Thus, short pipe, large diameter, with one bend, or water back with one return, or if a chamber only, the water will take care of itself, according to gravity. Bubbling will be sometimes caused in a very hot tank when the pressure is relieved by drawing, on the same principle as water below 212° boils in a partial vacuum.

(16) F. R. asks how to deaden the noise of a foot lathe, so that it will not be heard in the rooms below. A. We take the following from the *Workshop Companion*: 1. Rubber cushions under the legs of the work bench. *Chambers' Journal* describes a factory where the hammering of fifty copper-smiths was scarcely audible in the room below, their benches having under each leg a rubber cushion. 2. Kegs of sand or sawdust applied in the same way. A few inches of sand or sawdust is first poured into each keg; on this is laid a board or block upon which the leg rests, and around the leg and block is poured fine dry sand or sawdust. Not only all noise, but all vibration and shock are prevented; and an ordinary anvil, so mounted, may be used in a dwelling house without annoying the inhabitants. To amateurs, whose workshops are usually located in dwelling houses, this device affords a cheap and simple relief from a very great annoyance.

(17) F. J. B. writes: I have some large Mata stone vases with ornaments broken off in transportation, and for replacing need a nearly colorless and quickly setting cement that can be applied without heat, and that will stand outside weather if possible. Can liquid glass or white glue be prepared so as to answer the purpose? A. Try the following: Finely scraped old cheese, 1½ parts; quicklime in fine powder, 1 part; mix thoroughly, moisten with milk to a paste, and use at once, as it hardens very quickly. Instead of milk a strong aqueous solution of water glass or borax may be used. White lead (in oil) applied on cotton gauze may also be used advantageously.

(18) C. W. C. writes: I am fixing up a small mill to grind feed for my stock. It has a pair of sixteen inch burrs which run vertically, to be driven by a common 8 or 10 horse power with a 5½ or 6 inch belt over a 10 inch pulley. What should be the length of the belt? A. We think the driving and the driven shafts should not be less than 12 feet apart.

(19) A. B. writes: I wish to make some mirrors, will you give me formula for depositing the silver? Have tried carefully the Siemens method described in SUPPLEMENT No. 105, but do not succeed. What is the trouble? A. You have probably neglected to clean your glass properly, or your aldehyde ammonia was not right. Try again, or use Chapman's process.

(20) J. J. C. writes: In receipt for cements in No. 9, current volume, you mention fresh beaten blood, etc., for Chinese cement; what kind of blood shall I use? A. Use such as may be obtained at slaughter houses. Beat it with an egg beater.

(21) G. B. writes: Some three weeks ago the town council engaged a man to dig a well for the public. He agreed to dig a 5 feet in diameter well for $2 a foot in depth; owing to the nature of the ground he had to increase the diameter to 7 feet, which the council said they would receive, and pay him in proportion of above agreement. A dispute has now begun as to what it should be—the council say $28, and his mathematicians say $137.20. Who is right? A. The relative amount of earth removed will be as the square of two diameters; if the price for 5 feet diameter was $2.00 per foot, then for 7 feet diameter it would be as the square of 5 to the square of 7 or as 25 to 49—49

$$\frac{\;200\;}{25\,)\,9800}$$

$ 392 = 25 per foot and 3.92 × 35 feet = $137.20

(22) J. W. writes: Please give an easy and practical method of setting a locomotive engine eccentric while on the road in case it should slip. A. If the position of the eccentric on the shaft is marked, as it should be, you have only to set the eccentric to the marks and fasten; if not marked, place the crank on the proper center, throw the valve gear into its proper position, and turn the eccentric around till the cylinder takes steam freely, and fasten. Whether you turn the eccentric forward or back, will depend upon whether it is the go-ahead or the backing eccentric.

(23) E. De N. asks: Will a crooked pipe of the same size and length, having same pressure (for water head), pass as much water as a straight pipe would? A. No; every bend you make reduces the quantity delivered.

(24) A. S. D. asks: Do the steamboat inspection laws prohibit the use of portable boilers in small steamboats, such as small ferry boats, when the boiler is made of lawful iron and the tubes put close together as they are in portable sawmill boilers? A. They do not.

(25) F. A. writes: In answer to A. W. H. (7), of February 14, 1880, No. (7), I would say that I obtained a fair copy from an electrotype by means of the gelatin pad by saturating a cloth pad with the ink, then pressing it on the electrotype, and, when dry, placing the same face down on the pad. If A. W. H. has a better method I will be obliged to him for instructions.

(26) J. W. C. asks: 1. Is tool steel better than machinery steel for magnets? A. Tool steel hardened and drawn to a yellow makes a good magnet if properly charged. 2. Will the Callaud battery answer as well as a Bunsen battery for a telephone? If not, why? A. Either will answer, but the Leclanche is considered the best battery for this purpose.

(27) R. H. G. asks: 1. What holds the smooth surfaces together that Professor Tyndall speaks of as being held as well in vacuo as in the open air? A. The force of adhesion. 2. Also of what is celluloid made? A. See p. 335, Vol. 39, SCIENTIFIC AMERICAN, query 40.

(28) M. J. L. asks: 1. What size should a boiler be (light as can be made) to raise and hold two or three pounds of steam, to run an engine not exceeding one horse power? A. To run a one horse power engine, it should have 12 to 15 feet fire surface. The thickness of metal may be 1-16 inch if the boiler is cylindrical. 2. How could the steam be gauged with perfect safety? A. Use both a pressure gauge and a safety valve, or if the pressure is not more than three or four lb. you can use a column of water as a safety valve.

(29) S. A. G. asks: 1. What makes the mark on sawed lumber. Does each tooth make a mark when a circular saw is used? A. If the teeth are evenly set, each tooth will make its own mark; but if not, some one projecting tooth will mark more distinctly than the others. 2. What would be the power required to run a boat 60 feet long and 20 feet wide—size of cylinders and boilers? A. For a stern wheel boat 60 feet by 20 feet wide, 2 engines, 10 inch cylinder and 30 inch stroke; one flue boiler 46 or 48 inches diameter and 18 feet long.

(30) C. B. G. asks: What is the best fire escape from a third or fourth story window that a lady could manage and carry in her trunk, and where could I get it? A. We think there is nothing better than a good strong knotted rope.

(31) P. A. H. asks how to make a strong battery out of a few pile Leclanche battery. A. The elements of Leclanche battery are not suitable for any other form. If you wish to make a strong battery see directions given in SUPPLEMENTS, No. 157, 158, and 159.

(32) R. E. M. writes: We have two saws, one 54 inches in diameter, the other 60 inches diameter. Now, if both run at the same speed, which will consume the most power in doing the same work? Both saws are alike in all respects but as mentioned. A. The larger one.

(33) E. J. C. asks: 1. Can I construct an induction coil of No. 36 wire and No. 16 or No. 24 wire? I have these sizes on hand. A. For a large induction coil, No. 16 will do for the primary and No. 36 for the secondary. For small coils, use four or five layers of No. 18 or No. 20 for primary and No. 36 for secondary. 2. What size wire is generally used in sounders? I find 24 too large. A. Nos. 20 to 24 are used for local sounders, and for main line sounders Nos. 24 to 28, and in some cases wire as fine as No. 36 is used. The size depends entirely on the length or resistance of the circuit in which the instruments are used. 3. I constructed a telephone as shown in SUPPLEMENT, 142, Vol. 6, Fig. 4. It does not work as well as it should. Is it an exact representation of the Bell telephone? A. It is on the principle of the Bell telephone, and should work well if constructed according to the direction referred to.

(34) C. W. N. asks: How much will a ⅝ inch wire cable chain support? A. If you mean ⅝ inch diameter wire rope, about 14,000 lb.; if you mean chain of ⅝ inch diameter wire, about 26,300 lb. A safe working load is but one-fourth or one-fifth these weights.

(35) C. W. W. writes: A mechanical engineer of high standing claims that a pump will not draw water as high by running the pipe in a curve over a knoll as it would raise it vertically. As a proof of his assertion he states that it had been tried with a pump in good condition, to draw water out of a canal the bank of which was twenty-one feet eight inches above the level of the water. The pump was located about two hundred feet from where the pipe entered the canal. I claim that the pump or pipe must have been defective, as the only difference a curve would make would be what little additional friction the increased length of pipe, due to the curve, would have over a vertical lift equal to the highest point of the curve. I would state that the pipe in question was large enough to supply the pump under any condition. A. The curve makes no difference in the height the pump can lift, save only the increased friction, but the pipes must be tight; with the curved pipe as described, it is really a siphon in form, and if there be the slightest air leak, the air will collect at the top of the curve and thus stop the action of the pump. There should be a cock or valve at the highest point to let off the air.

(36) W. H. M. asks: 1. What are the requisite qualifications to become a locomotive fireman? A. Activity, faithfulness, sobriety, close observation, and a cool head. 2. Who are the proper persons to apply to for a situation? I don't think it is the master mechanic, as I have written to several and have received no answer. A. The master mechanic or superintendent. 3. In link motion, is it necessary for every hanger to be a little above or below the central line of motion? Will it not work just as efficient by being exactly upon the line of motion? A. It depends upon the proportion of the parts. 4. Which is the accepted mode of firing a locomotive boiler? A. There is no accepted mode, as the treatment differs with different fuel and different service; the best mode with any particular fuel and service is the result of experience.

(37) W. T. S. asks (1) whether 12 ⅝ inch stay bolts are sufficient to stay the top sheet of a fire box 24x40 inch; one end of the bolts are turned into an eye, the other end running through a clevis with a nut on, steam pressure to be 120 lb. per square inch. A. No; you should have at least 30 stays, ¾ inch or ⅞ inch diameter. 2. Would there be any objection in using steam from two boilers, by running a steam pipe from the smaller boiler into the larger one, running the pump on the smaller boiler to supply it with water? A. No.

(38) S. F. A. writes: We have a difference of opinion in the shop (U. P. R. R. machine shop) in regard to how a key should be fitted in a driving wheel. One party claims that the key should be fitted to bear the hardest, top and bottom; and the other party claims that it should be fitted to bear the hardest on the sides. A. The key should be a close fit at the sides, but have no draught; all the draught should be on top and bottom.

(39) W. H. D. asks how in using a "Richards" indicator for taking diagrams from steam engines, one is sure to have the proper spring inserted in the instrument. The indicator lent me has several springs all stamped with different numbers, which to an amateur like myself are very puzzling. I want to take diagrams from different engines, under varying pressures of steam, say with 20, 30, 40, 50 lb., and up to 100 lb. pressure in the boiler. I suppose I must change the springs for each rise or fall in pressure I work at, as the springs indicate each a course from some being stronger than others; 40 to 50 lb. will probably be what I will use most. A. The numbers on the springs are the number of pounds one inch in height of the cards made with that spring will represent. If you are using, say a spring marked 40, then in marking off the card, you will divide each inch in height into 40 parts, each part being one pound per square inch, and so with a spring marked 20, divide each inch into 20 parts, etc. There should be with the indicator a scale corresponding to each spring and marked 20 scale, or 30 scale, or 40 scale; these scales are to be used in measuring a card made by a corresponding spring.

(40) E. E. K. asks: 1. What is the weight of an ordinary locomotive without tender? A. For passenger engines 50,000 to 70,000 lb., for freight engines 70,000 to 80,000 lb. 2. What is the weight of the tender? A. Depends upon their capacity. 3. What proportion of the locomotive rests on the drive wheels? A. In passenger engines about two-thirds, in freight engines from four-fifths to the whole. 4. Is there any device in use to prevent drive wheels from slipping, outside of the use of sand? A. None successful that we are aware of.

(41) D. L. writes: I wish to locate two hydraulic rams to work together; the fall is 10 feet, and length of entry pipes 25 feet. The water is to be raised 80 feet through a pipe 1,000 feet long. Will they raise the same quantity of water through a tube of 2 inches diameter as through one of 1 inch diameter (outlet tube of course)? Would the rams work successfully in case the tube were 4 inches diameter? A. The rams will operate better through a 2 inch than a 1 inch pipe. No objection to the pipe being 4 inches diameter.

(42) H. S. asks: 1. What pressure will mercury flasks bear for a steam boiler, as in SUPPLEMENT, No. 182? A. We do not know the test to which mercury flasks are submitted; but they will undoubtedly bear ten times the pressure usually carried on steam boilers. 2. How many flasks, and what size cylinder and propeller would it require for a Sharpie 26 feet long, 6½ feet beam, to go eight to ten miles per hour? A. 20 flasks submitted to the fire, and 4 or 6 for steam reservoir; engine 4 inch by 4 inch stroke; propeller 24 or 26 inches diameter, and 33 to 38 inches pitch.

(43) P. H. asks: 1. Should in the speed of circular saws there be any difference for a cross cut and a rip saw? A. No difference of speed between a cross cut and rip saw. 2. What should be the speed of the cylinder of a planer (surfacer), and what the feed for soft wood work, such as general mill work, and what for hard wood work, such as furniture? A. For a planer, about 800 revolutions per minute; the feed must depend upon the character of the wood and condition of the knives. 3. What is the proper speed of a band and what for a scroll saw? A. Speed of band saw 6,000 feet per minute; speed of scroll saw if well constructed and balanced, from 800 to 1,000 strokes per minute.

(44) J. C. B. asks: Can you give me any remedy that will drive off or kill water bugs? Our house is becoming infested with them. A. Persian insect powder thoroughly blown into all the crevices at the wall, around the water pipes, and around range will generally dislodge and kill them. The powder should be applied once a week for three or four weeks.

(45) J. G. S. asks: Can you tell me through the SCIENTIFIC AMERICAN how I can copper plate or silver plate small brass articles without a battery, or how to make a battery and liquid to do it as cheaply as possible? A. You will find on p. 810 (15), Vol. 40, of SCIENTIFIC AMERICAN, directions for making a silvering solution to be applied with a cloth, and on p. 219 (43), same vol., there are directions for coppering castings.

(46) J. S. B. writes: In your issue of March 20, under "Notes and Queries," your correspondent, B. S. (19) complains of the wasting away of copying pad in cleaning after use. There is no necessity for cleaning off the impression. If the pad is laid aside for 24 hours it will be found that the ink has been entirely absorbed, and a perfectly clear surface is left for another copy.

(47) S. B. G. asks: 1. Why was Cleopatra's monolith named a needle? A. Slender rock columns, whether natural or artificial, are commonly called "needles." 2. Has Cleopatra's needle reached New York yet? A. No. 3. In what part of the city will it be set up? A. Not decided. 4. Does the Cassiquiari River in Brazil always flow in the same direction? A. No.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. W. G.—Nickeliferous pyrrhotine—worth an analysis.—J. M.—Quartz, with sulphide of iron—not valuable. —J. W. K.—Magnetite—magnetic oxide of iron—in gneiss rock.—J. B. G.—It is quartz rock—of no value.

COMMUNICATIONS RECEIVED.

Report of Weekly Meeting of Polytechnic Association.

On the Iowa Meteorite. By A. W. B.

Curiosities of the Key Board. By

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 9, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Alcoholic vapors in water, apparatus for collecting, M. Culmer ... 225,340
Aluminous cake, making, C. V. Petraeus ... 225,300, 225,301
Animal trap, T. Wilson ... 225,234
Audiphone, T. W. Graydon ... 225,364
Augers, operating earth, G. H. Wood ... 225,433
Axle box, car, G. W. Brownell ... 225,389
Axle box, car, T. Haynes ... 225,319
Baling press, A. M. Paxton ... 225,416
Barrel machine, L. Smith ... 225,403
Bedstead, folding cabinet, A. W. & C. T. Kendrick ... 225,388
Belt fastening, R. McCully ... 225,435
Bicycle brake, S. Sawyer ... 225,289
Boiler furnace, steam, J. Mahony ... 225,409
Book for holding blank forms, A. J. Clark ... 225,343
Boot and shoe, J. T. Shaw ... 225,422
Boot and shoe, R. W. Witham ... 225,431
Boot and shoe sole burnishing machine, D. C. Mathews ... 225,229
Boot or shoe measure, O. H. Cushman ... 225,210
Boring machine, G. Gardner (r) ... 9,114
Boring tool, metal, L. C. Little ... 225,291
Bottle stopper, S. S. Newton ... 225,288
Bottle washing machine, C. Michel ... 225,280
Brake lever, A. C. Fish ... 225,354
Brick machine, C. T. Hemenway et al. ... 225,263
Brick machine, J. A. Reeder ... 225,413
Building blocks, pottery shape for, A. Campbell ... 225,338
Bulletin board, Watkinson & Whelan ... 225,440
Burglar alarm, electric, C. H. Carter ... 225,271
Button, A. D. Jeffrey ... 225,380
Button holes, eyelets, etc., stitching, J. A. House ... 225,361
Car brake, L. S. Hoyt ... 225,382
Car center plate, railway, O. Bradley, Jr. ... 225,332
Car coupling, Myer & Skinner ... 225,410
Car door sill, grain, D. F. Van Liew ... 225,441
Car starter, A. Stewart ... 225,430
Cars, apparatus for delivering railway ties from, J. Pusey ... 225,216
Cars, implement for moving, J. M. Brown ... 225,336
Cars to moving trains, device for attaching, A. B. Chapin ... 225,272
Carpet stretcher, J. A. Dice ... 225,218
Carriage spring, W. H. Brace ... 225,334
Caster, furniture, C. Brinton ... 225,335
Chain guide, oscillating band, A. Bux ... 225,391
Chair, E. J. Smith ... 225,421
Charcoal kiln, W. A. Miles ... 225,296, 225,297
Clothes pounder, J. Kaiser, Jr. ... 225,202
Coffee or spice mill, O. W. Stow ... 225,246
Coke oven, beehive, S. Dinscher ... 225,254
Cooking apparatus, steam, J. Ashcroft ... 225,317
Cooking vessel, W. Y. Thomson ... 225,340
Copy holder, A. Iskel ... 225,396
Cornice, adjustable window, J. W. Campbell ... 225,339
Corset, abdominal, S. A. Cuningham ... 225,211
Corset steel fastening, L. Hill ... 225,315
Cotton chopper and cultivator, comb'd, W. S. Neal ... 225,412
Cradle, rocking, J. W. Mucha ... 225,298
Crank and wheel for machinery, comb'd, H. Young ... 225,434
Crimping machine, Stobbard & Fifield ... 225,404
Cultivator, A. Aker ... 225,304
Cultivator, A. Stauffacher ... 225,304
Cutlery, pocket, J. D. Frary ... 225,310
Dentaphone, T. W. Graydon ... 225,365
Dentist's chair, B. T. Starr ... 225,402
Dividers, J. F. Sullivan ... 225,437
Door check, C. Hooper ... 225,340
Dredging machine attachment, J. A. Ball ... 225,326
Dust pan, E. J. Riley ... 225,346
Dyeing and washing yarn, cloth, etc., apparatus for, H. P. & W. Gray, Jr. ... 225,363
Electric conductor, underground, A. T. Boone ... 225,279
Electro-magnetic motor, J. S. Lamar ... 225,396
Extinguishing device, F. E. Dailey ... 225,300
Fan, H. Clayton ... 225,344
Fan, fly, S. B. Opdyke ... 225,413
Felly for wheels, metal, H. E. Lambert ... 225,225
Fermenting casks, ventilating valve for, H. Goth ... 225,360
Firearm, breech-loading, V. Sauerbrey ... 225,420
Fire lighter, B. Swift ... 225,244
Fuel burning apparatus, S. B. King ... 225,223
Furnace, T. M. Fell ... 225,407
Gag runner, R. W. Jones ... 225,391
Game apparatus, J. Miles ... 225,407
Gas, apparatus for enriching and economizing coal, G. T. Strong ... 225,430
Gong, alarm, C. F. West ... 225,447
Grain binder, J. Bingham ... 225,329
Grain decorticating and cleaning apparatus, U. Boucher ... 225,330
Grain separator, J. Grabe ... 225,262
Grain separator, H. E. Wright et al. ... 225,263
Grate bar, D. Reilly ... 225,419
Grater, vegetable, F. Wittenmuler ... 225,343
Grinding mill for grain, middlings, etc., Higginbottom & Hutchinson ... 225,374
Gun wad, J. Netmeyer ... 225,412
Hair pin, A. J. Shipley ... 225,428
Hair pin, J. R. Smith ... 225,430
Hammering draw plates, machine for, C. D. Rogers ... 225,298
Harness, T. Boardman ... 225,329
Harrow, J. & G. S. Waggoner ... 225,444
Harrow, wheel, F. Bramer ... 225,391
Harrow, wheel, C. La Dow ... 225,394
Harvester and thrasher, comb'd, C. J. F. Williams ... 225,448
Harvester reel, W. H. H. Freeman ... 225,360
Hat pouncing and shaving machine, J. B. Brown ... 225,270
Hat, ventilating, H. O. Pearce ... 225,236
Hay press, L. B. Lathrop ... 225,396
Headlight, signal, M. Nicholson ... 225,389
Hog trough, W. G. Vincent ... 225,309
Hoop bending machine, J. W. Jones ... 225,242
Horn and shell goods, making, L. Tillinghast ... 225,247
Horse power, B. C. Wade ... 225,445
Horse rake, F. B. Kohler ... 225,390
Horseshoe, J. R. Williams ... 225,300
Horseshoe bending machine, J. R. Williams ... 225,257
Horseshoe blanks, creasing machine for, J. R. Williams ... 225,258
Horseshoe blanks, machine for cutting off, J. R. Williams ... 225,252
Horseshoe blanks, machine for trimming, J. R. Williams ... 225,254, 225,256
Horseshoe blanks, making, J. R. Williams (r) ... 9,111
Horseshoe swaging die, J. R. Williams ... 225,253
Horseshoes, die for forming toe clips in, J. R. Williams ... 225,255
Horseshoes, manufacture of, J. R. Williams ... 225,250
Hose, applying bands to, O. T. Earle ... 225,224
Hose, cut, J. Bigelow (r) ... 9,118
Hydraulic elevator, J. R. McPherson ... 225,294
Hydro-pneumatic apparatus, T. A. Martin ... 225,291
Ironing table, G. W. De Mott ... 225,372
Journal bearing for shafts, C. C. Klein ... 225,224
Key blanks, manufacture of, P. Mathon ... 225,227
Kite, J. Thompson ... 225,248
Lamp, J. G. Greene ... 225,365
Lamp, electric, E. Weston ... 225,312
Lantern, signal, R. W. Lewis ... 225,397
Lead and crayon holder, J. Hoffman ... 225,379
Lead, preparation of metallic, A. K. Eaton ... 225,356
Lifting, carrying and lowering heavy bodies, apparatus for, J. C. Moore ... 225,408
Loom let-off mechanism, J. D. Cottrell ... 225,346
Mashing machine, A. Dierychx ... 225,313
Meat and vegetable slicer, A. & A. Iske ... 225,387
Meat hook, B. F. Clark ... 225,345
Mechanical movement, J. D. Wright ... 225,302
Medicine case, Barnett & Hurlburt ... 225,320
Metal bending tool, S. Patterson ... 225,415
Middlings purifier, A. R. Gubber ... 225,218
Millstone dressing machine, E. H. C. A. T. Vulpius ... 225,442
Moulded articles of manufacture, composition of matter for making, O. F. Woodward ... 225,161
Moulding apparatus, G. Woolnough ... 225,304
Motion, device for converting, Hitchcock & Wakeman ... 225,376
Mower and bearing, lawn, E. F. Morse ... 225,322
Nail plate feeder, A. Trumbour ... 225,440
Netted fabrics, frame for drying, H. Dewasle ... 225,212
Nut punching machine, W. Shields ... 225,429
Packing for piston rods, metallic, T. Tripp ... 225,307
Packing, piston, T. Tripp ... 225,308
Padlock, F. W. Mix ... 225,406
Pantaloons, J. W. Lingard ... 225,399
Paper bag machine, E. O. Bennett ... 225,322
Paper box, J. B. Parker ... 225,411
Paper cutting machine, F. R. & T. W. Sheridan (r) ... 9,113
Paper for detective purposes, treating, N. J. Heckmann ... 225,372
Paper, preparation of bank note, B. Hayward ... 225,370
Paper pulp, machine for separating the fibers of wood for, F. & G. C. Rose (r) ... 9,110
Paper, repulping, C. Coon ... 225,347
Peach stoner, J. K. Hogan ... 225,379
Pea cutter, E. Holmes ... 225,384, 225,385
Pen, stylographic fountain, C. W. Livermore ... 225,401
Pencil case, C. L. Downes ... 225,214
Phototype plates, producing, E. Jacobi ... 225,389
Pianoforte key pedal, T. H. Kaslin ... 225,289
Pipe joint, flexible, A. Bataille ... 225,327

Pitcher, ice, H. Vasseur ... 225,440
Planter, corn, J. W. Atkinson ... 225,316
Planter, seed, E. F. Dunaway ... 225,373
Planters, marking and dropping attachment for, W. F. Sooler ... 225,436
Plow, A. L. Chubb ... 225,341, 225,342
Plow, R. T. Semmes ... 225,425
Plow, reversible, J. L. & G. L. Woodbury ... 225,403
Plow, side hill, W. Strait (r) ... 9,116
Plow, sulky, L. Berthiaume ... 225,307
Pole and shaft, vehicle, M. T. Jackson ... 225,221
Postal card, H. E. W. Barton ... 225,316
Printing apparatus, cash controlling, C. Abele ... 225,301
Printing press delivery apparatus, J. T. Hawkins ... 225,390
Pulp machine, wood, J. W. Martin ... 225,208
Pump, D. C. Lee ... 225,206
Pump, L. D. Railsback ... 225,415
Pump, ship's, C. V. Decker ... 225,252
Rail joint, W. F. Ash ... 225,364
Reaction and direct action engine, Du Motay & Beckwith ... 225,245
Reaming bit, expansible, A. Arnts ... 225,305
Reapers and mowers, rake reel for, J. Amstutz ... 225,183
Reclining chair foot rest, R. & W. McCabe ... 225,290
Revolving screen, L. J. Bennett ... 225,306
Rheumatism remedy, P. J. Welch ... 225,146
Rod and pipe cutter, F. I. Mastie ... 225,403
Rotary engine, R. Lenchsenring ... 225,226
Saddle, harness, C. Steinbach ... 225,342
Sailor's ditty box, Hitchcock, Jr., & Reed ... 225,377
Saw tables, device for adjusting, J. Bennett ... 225,233
Screw cutting machine, B. Stott ... 225,315
Screw machine, wood, J. H. Greenleaf ... 225,377
Service pipe box, Hummer & Gemmill ... 225,395
Sewer connection, M. Schmitt ... 225,424
Sewing machine, J. Bigelow (r) ... 9,112
Sewing machine roller presser, F. Diehl ... 225,274
Sewing machine spool case, Terrell & Travis ... 225,407
Sewing machine tucker, Johnson & Reynolds ... 225,290
Shelter, portable, G. I. Herbert ... 225,372
Shower bath apparatus, portable, J. R. Vassnol ... 225,430
Skate, J. H. Forshay ... 225,376
Skate, roller, A. French ... 225,282
Skiving machine, F. M. Carter ... 225,340
Slate, school, N. Du Brul ... 225,215
Sliding gate, A. F. Miller ... 225,286
Smoke and dust arrester for railway cars, White & Henderson ... 225,448
Soap, fluid, R. W. Lincoln ... 225,400
Soap press, C. L. Ingalls ... 225,297
Sod cutter, M. N. Bettiew ... 225,324
Spark arrester, Craig & Wyman ... 225,210
Spark extinguisher, G. L. Blewett ... 225,326
Spoke throating machine, Doane & Hughes ... 225,352
Steam engine, J. D. Davies ... 225,351
Stove, C. H. Blanchard ... 225,238
Stove, heating, J. P. Oeth ... 225,264
Stove, steam, S. Silsbee ... 225,310
Straw stacker, L. N. Clark ... 225,344
Stud and button, P. & S. Bulot ... 225,207
Telephone line alarm, Barker & Edmonston ... 225,321
Telephone lines, signaling apparatus for, G. H. Bliss ... 225,327
Telephone transmitter, J. H. Irwin ... 225,390
Tether, W. H. Maxey ... 225,404
Thill coupling, W. H. Brace ... 225,320
Thrasher and separator, grain, M. Williams ... 225,450
Thread cleaner, T. Pfeigne ... 225,217
Tin vessel, O. J. Backus ... 225,304
Tire upsetting machine, J. W. Hudson ... 225,396
Tobacco, improving the color and quality of leaf, G. Robinson ... 225,422
Tobacco rolling and covering machine, C. A. Snyder ... 225,241
Umbrella covers, machine for cutting, G. F. Wachtershauser ... 225,445
Umbrella support, T. Mora ... 225,409
Undershirt, A. J. Wheeler ... 225,219
Valve, balance slide, E. Haug ... 225,379
Valve, globe, W. A. Hart ... 225,383
Valve, straightway, R. W. McCormick ... 225,289
Vehicle spring, G. Hubert ... 225,264
Velocipede, A. Vreeland ... 225,310
Wagon seat, J. H. Rhamy ... 225,420
Washing machine, J. Anderson ... 225,301
Washing machine, W. Haas ... 225,279
Washing machine, Wentworth & Colby ... 225,301
Watch barrel attachment, H. A. Riggs ... 225,421
Watches, winding arbor for stem winding, W. P. Hillick ... 225,289
Water closet, M. F. Gale ... 225,363
Water conductor, G. K. Reber ... 225,257
Water wheel, E. H. Higginbotham ... 225,373
Whiffletree, C. Hassinger ... 225,371
Whiffletree, H. M. Whitehead ... 225,296
Whip socket fastener, A. E. Hawley ... 225,291
Window screen, O. F. Howe ... 225,383

DESIGNS.

Button card, G. P. Farmer ... 11,671
Buttons, J. Rowbotham ... 11,675
Carpet, H. Horan ... 11,674
Clock frame, L. B. Tuttle ... 11,676
Flush bolt, H. Jaworski ... 11,670
Handkerchief, A. Tilt ... 11,673
Knit fabrics, S. Conde ... 11,669, 11,630
Scarf pin, J. Paxton ... 11,672
Vase and pedestal, W. Bayley ... 11,677

TRADE MARKS.

Chemical purposes, plumbago crucibles and other plumbago ware for, Patent Plumbago Crucible Company ... 7,849
Food, prepared baby, Mauger & Petrie ... 7,848
Medicinal preparation, Geery & Co ... 7,847
Paper, wrapping and writing, Mary & Co. ... 7,851
Soap, C. S. Higgins ... 7,850

English Patents Issued to Americans.

From March 5 to March 9, 1880, inclusive

Boiler, steam, W. M. Fisher et al., Cincinnati, O.
Bolting machine, C. J. Shuttleworth et al., Springville, N. Y.
Disinfecting apparatus, K. J. Mallett, Jr., N. Y. city.
Hoisting blocks, R. L. Shute, Cincinnati, O.
Iron lenders, manuf. of, E. J. Latius, Jersey City, N. J.
Knitting machinery, W. H. McNary, B'klyn, N. Y.
Lacing apparatus for boots, etc., W. H. Decker, New York city.
Lamp, electric, J. H. Guest, Brooklyn, N. Y.
Motor, E. L. Brady, New York city.
Organs, etc., apparatus for playing by electricity, J. Y. Smith, Pittsburg, Pa.
Spinning mules, H. Hendry, Newark, N. J.
Umbrellas, A. H. Ege, Mechanicsburg, Pa.
Vessels for aerial navigation, A. L. Blackman, Nashville, Tenn.
Vehicles for carrying grain in bulk, T. T. Prosser, Chicago, Ill.
Wringing and mangling machine, J. Clark, N. Y. city.

PROSPECTUS
OF THE
Scientific American
FOR 1880.
The Most Popular Scientific Paper in the World.

VOLUME XLII. NEW SERIES.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

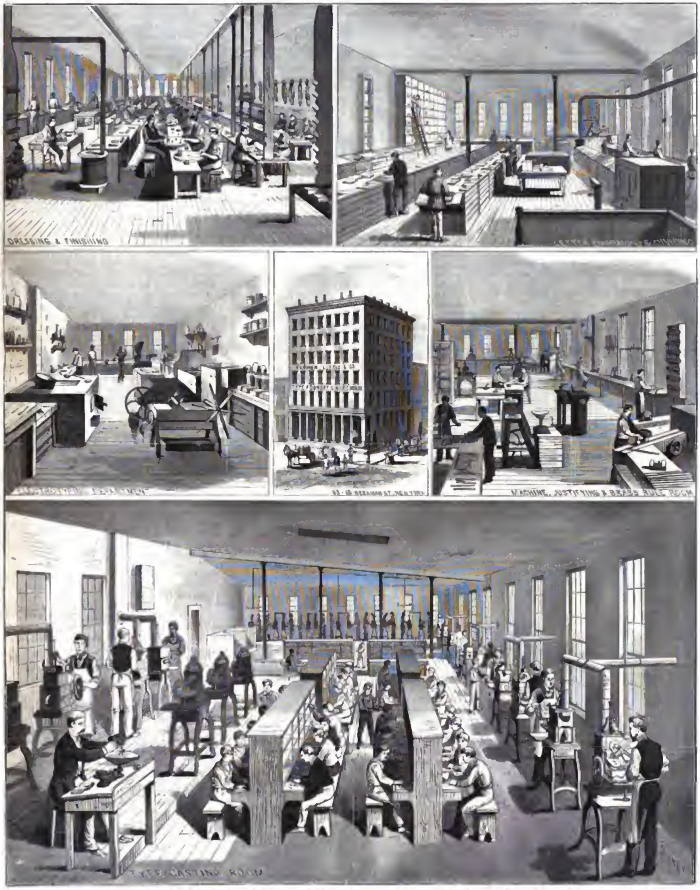
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 16. [NEW SERIES.] | NEW YORK, APRIL 17, 1880. | $3.20 per Annum. [POSTAGE PREPAID.]



THE MANUFACTURE OF PRINTER'S TYPE—FARMER, LITTLE & CO.'S FOUNDRY NEW YORK CITY.—[See page 244.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, APRIL 17, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 224.
For the Week ending April 17, 1880.
Price 10 cents. For sale by all newsdealers.

THE NATIONAL PLANT OF THE CHINESE.

The uses of the bamboo, says Dr. S. W. Williams (author of "The Middle Kingdom"), are so numerous as to entitle this grass to be called the national plant. It grows naturally throughout the country nearly to the latitude of Pekin, diminishing in size and strength as one goes northward. The varieties induced during the long period of its culture are numerous, and a native writer on its propagation observes at the outset of his treatise that he could not undertake so much as to name them all, and would therefore confine himself to a consideration of sixty three of the principal. Some of them are like trees, forty or fifty feet high, with culms eight inches in diameter at the root; others resemble pipe-stems through their length, graceful and slender as a magician's wand; while one kind presents a black, and another has a bright yellow skin. This plant may well be called useful, for it is applied by the Chinese to such a vast variety of purposes that they are puzzled to get along without it when they emigrate where it does not grow. The tender but tasteless shoots are cut for food, either boiled, pickled, or comfited, as the customer wishes. The seeds, too, furnish a farina suitable for cakes, and the Chinese have a proverb that the bamboo flowers chiefly in years of famine. The gnarled roots are carved into fantastic images of men, birds, monkeys, or monstrous perversions of animated nature; cut into lantern handles or canes, known in commerce as "whangees;" or turned by the lathe into oval sticks for worshipers to divine whether the gods will bear or refuse their petitions.

The tapering culms are used for all purposes to which poles can be applied in carrying, supporting, propelling, and measuring, by the porter, the boatman, and the carpenter in all cases where lightness, strength, and length are requisites. The joists of houses and the ribs of sails, the shafts of spears and the wattles of hurdles, the tubes of aqueducts and the rafters of roofs, the handles of umbrellas and the ribs of fans are all constructed of bamboo. The leaves are sewed upon cords in layers to make rain cloaks, swept into heaps for manure, matted into thatches, and used as wrappers in cooking rice dumplings. Cut into slivers of various sizes, the wood is worked into baskets and trays of every form and fancy, twisted into cables, plaited into awnings over boats, houses, and streets, and woven into mats for the scenery of the theater, the roofs of houses, and the casings of goods. The shavings even are picked into oakum and mixed with those of the rattan, to be stuffed into mattresses. The bamboo furnishes material for the bed and the couch, chop-sticks to use in eating, pipes for smoking, flutes, curtains to hang in the doorway, brooms, screens, stools, coops, stands, sofas, and other articles too numerous to mention, of household necessity and luxury. The mattress to lie on, the chair to sit upon, the table to dine from, the food to eat, and the fuel to cook it with are alike derived from it. The ferule to govern the pupil and the book he studies both originate here. The tapering tubes of the native organ and the dreaded instrument of the lictor, the skewer to pin the hair with, and the hat to screen the head, the paper to write on, the pencil to write with, and the cup to hold the pencils; the rule to measure lengths, the cup to gauge quantities, and the bucket to draw water; the bellows to blow the fire with and the tube to hold the match; the bird cage and the crab net, the life preserver and the children's buoy, the fishpole and sumpitan, the water-wheel and eaves-trough, sedan, wheelbarrow, and handcart, with scores of machines and utensils, are one and all furnished or completed by this magnificent grass, the graceful beauty of which when growing is comparable to its varied usefulness when cut down.

China could hardly be governed without the constant application of the bamboo, nor could the people carry on their daily pursuits without it. It serves to embellish the garden of the patrician and shade the hamlet of the peasant; it composes the hedge which separates their grounds, assists in constructing tools to work their lands, and feeds the cattle which labor on them. The boatman and weaver find its slender poles indispensable to their trades, while there is nothing the artists paint so well on wares and embroideries. The tabasheer found in the internodes has its uses in native pharmacy, and the silicious cuticle furnishes the engraver a good surface for carving and polishing.

THE METROPOLITAN MUSEUM OF ART.

The new building of the Metropolitan Museum of Art, in Central Park, New York city, was officially declared open to the public March 30. A large number of prominent citizens were present, including President Hayes and the Secretary of State. In accepting the building from the Park Department, the president of the museum spoke of the encouraging beginning that had been made in art collections, and said that the department devoted to industrial art promised to be soon filled. The industrial art schools had made a good beginning and were proving successful. The main address of the occasion was delivered by Joseph H. Choate, on the history and future plans of the museum. Mr. Choate said that the aim of the trustees was not to establish a mere cabinet of curiosities which should serve to kill time for the idle, but gradually to gather together a more or less complete collection of objects illustrative of the history of art in all its branches, from the earliest beginnings to the present time, which should serve not only for the instruction and entertainment of the people, but should also show to the students and artisans of every branch of industry in the high and acknowledged standards of form and of color, what the past had accomplished for them to imitate and excel.

It was also a prominent feature of the plan, in which some progress has already been made, to establish a Museum of Industrial Art, as distinct from the beautiful in art, for the direct and practical instruction of artisans, showing the whole progress of development from the raw material, through every artistic process to the most highly wrought product of which art is capable.

The building now open forms one twelfth of the plan of the grand structure proposed for the museum.

AIDS FOR THE DEAF.

Dr. C. H. Thomas, of Philadelphia, has been making a careful study of audiphones, dentiphones, and other devices for helping the deaf to hear. As stated in a lecture before the Philadelphia County Medical Society, since published in the *Medical Times*, the objects sought in his investigations were:

(1) To demonstrate the principles upon which their action is founded; (2) to determine the practical value and range of use of these instruments, (3) to devise other and more convenient and less conspicuous forms of mechanism which might be substituted for them; (4) to improve the quality and increase the volume of the sound conveyed; (5) to discover new physiological and pathological facts relating to the functions of vocalization and hearing; and (6) to throw open to professional, and so to public, use the results gained, thus supplying data for further investigation and invention.

It appeared that both the audiphone and dentiphone depend for their action upon the principle of acoustics that solids—in this case in the form of thin plates—vibrate in unison with the sound waves produced in the air near them. In these instruments the vibrations are of sufficient force to be audible when conveyed to the internal ear through the medium of the teeth and cranial bones, independently of the ordinary channel of hearing—the transmission being direct in the audiphone and indirect through the conducting string in the dentiphone. In the audiphone not tension but the arched form is the condition essential to its proper action, for this form is that best adapted to impart the impact of sound waves against its convexity, which is then expended as thrust of the arch against the teeth, these forming one of its abutments.

To do away with conspicuousness and inconvenience of these instruments, Dr. Thomas made one in which the large receiving diaphragm was attached to a curved rod of wood or metal, like a pipe-stem. In this way the diaphragm was supported below the level of the face by the curved stem held firmly between the teeth, allowing the user to have his hands free and his face uncovered. In experimenting with different materials for diaphragms it was found that when substances lacking in resonance were used (such as celluloid and binder's board) flatness of tone resulted. Substances, which were over-resonant or over-persistent in their vibrations (as vulcanite and ferrotype metal) yielded ringing or confused sounds. The quality needed is that possessed by good sounding boards, of instantly responding to contiguous sounds and maintaining them during their continuance, and also of instantly ceasing to vibrate upon the cessation of the causative sound. This right sort of elasticity of resonance, that capable of reproducing human voice tones in their purity, is possessed to a high degree by fuller's board (or press board), which, when treated with shellac varnish and thoroughly dried, has proved not only far better than other paper or cardboards, but is also a great improvement upon the sheet metals or hard rubber, lacking the "reverberations" and "roaring sounds" of the latter, as they are described by different patients upon whom they have been tested. Besides, owing to its greater elasticity, it is less destructible than either these or the thin sheets of wood which otherwise answered the purpose, while its cost is but trivial.

The simplest instrument, one that excels either the audiphone or the dentiphone in the volume of sound transmitted, consists simply of a small rod of hard wood—a convenient size being about two feet long and a quarter of an inch thick—one end of which is placed against the teeth of the speaker, the other resting against or between the teeth of the person hard of hearing. If the speaker now articulates in a natural tone of voice, the vocal vibrations will be transmitted in great volume through the teeth and thence to the ears of the deaf person.

Later observations show that it will also convey the voice distinctly when placed against the forehead or other portions of the skull of the hearer. It will also convey perfectly audible speech from the skull of one to that of the other, or in its absence such sounds may be conveyed by simply bringing the heads themselves in contact. Again, instead of the speaker holding it against his teeth, he may place it against the upper part of his chest, when, upon using his voice, the sound will be conveyed as before, of course independently of the teeth of either person.

That these instruments are of great value in a considerable proportion of cases of deafness, Dr. Thomas thinks there is no reason to doubt, but there is, in his opinion, no just ground for the public belief that with their aid the deaf are enabled to hear as well as those with ordinary hearing. On the contrary, they supply but a very small fraction of normal hearing—much *less* than a *hundredth part*. The difference between normal hearing and that derived through these means is hardly less marked than that between sunlight and candle-light; nevertheless, this very small fraction is a priceless value in many cases, for to those who practically hear nothing without them, who sit in acoustic darkness, the gain

is all the difference between nothing and something—scarcely less than infinity.

In view of certain strongly expressed statements which have obtained currency, the results to be derived from the use of the audiphone in deaf mutism are likely to prove very disappointing. Repeated tests show that those who are able to hear with the aid of the audiphone hear *their own voices* perfectly without it; while those who are unable to hear their own voices without it can hear no other voice with it.

SOME ELECTRICAL MEASUREMENTS OF ONE OF MR. EDISON'S HORSESHOE LAMPS.

BY HENRY MORTON PH.D., ALFRED M. MAYER, PH.D., AND B. F. THOMAS, A. M., AT THE STEVENS INSTITUTE OF TECHNOLOGY.

Much has been written and said within the last few months on the subject of Mr. Edison's new horseshoe lamps, and with all the writing and saying there has been wonderfully little produced in the way of precise and reliable statement concerning the simple primary facts, a knowledge of which would give the means of estimating both the scientific and commercial status of this widely discussed invention.

It was, therefore, with great pleasure that the present writers found themselves, through the kindness of the SCIENTIFIC AMERICAN, placed in possession of one of these horseshoe lamps of recent construction.

To satisfy themselves as to the real facts of the case they soon made a series of careful measurements and determinations, and as the results of these are likely to interest others, they now put them in print for general benefit.

A further examination of other lamps would have been made at the same time had opportunity offered; but as a communication on this subject addressed to Mr. Edison did not evoke a reply, they are obliged to content themselves with the one lamp as a subject of experiment.

They would, however, here remark that the behavior of this lamp, under the tests, and the agreement of its results with information otherwise obtained, convince them that it is at least a fair specimen of the lamps of this form so far produced at Menlo Park.

The first object, on receiving the lamp, was to determine roughly what amount and character of electric current would be needed to operate it efficiently. With this view a number of cells of a small Grove's battery were set up, having each an active zinc surface of twenty square inches and a platinum surface of eighteen square inches.

The lamp being placed in the situation usually occupied by the standard burner in a Sugg's photometer, the battery was, cell by cell, thrown into circuit.

When ten cells had been introduced the horseshoe showed a dull red, with fifteen cells a bright red, with thirty-four cells the light of 1 candle was given, with forty cells the light of $4\frac{1}{2}$ candles, and with forty five cells the light of 9_8 candles, and with forty-eight cells 16 candles.

Having thus determined what amount of electric current would be required for experiments, arrangements were made to measure accurately the resistance of horseshoe while in actual use and emitting different amounts of light. The resistance of this carbon thread at the ordinary temperature had been already determined as 123 ohms in the usual way, but it was presumed, as had been shown by Matthiessen (*Phil. Mag.*, xvi., 1858, pp. 220, 221), that this resistance would diminish with rise of temperature.

To measure the resistance under these circumstances the apparatus was arranged as follows: The current from the battery was divided into two branches, which traversed, in opposite directions, the two equal coils of a differential galvanometer. One branch then traversed the lamp, while the other passed through a set of adjustable resistances composed of German-silver wires stretched in the free air of the laboratory, to avoid heating. (Careful tests of these resistances showed that no sensible heating occurred under these circumstances.)

Matters being thus arranged, the resistances were adjusted until the galvanometer showed no deflection when the candle power of the lamp was taken repeatedly in the photometer, and the amount of resistance was noted.

These measurements were several times repeated, shifting the coils of the galvanometer and reversing the direction of the current.

The results so obtained were as follows:

Resistances.		Condition of Loop.
123	ohms	Cold.
94	"	Orange light.
88·7	"	$\frac{8}{10}$ candle.
79·8	"	5 "
75	"	18 "

The photometric measurement was in all these cases taken with the carbon loop at right angles to the axis of the photometer, which was, of course, much in favor of the electric lamp. On turning the lamp round so as to bring the carbon loop with its plane parallel with the axis of the photometer, *i. e.*, the edge of the loop turned toward the photometer disk, the light was greatly diminished, so that it was reduced to almost one-third of what it was with the loop sideways to the photometer disk.

Having thus determined the resistance of the lamp when in actual use, it was next desirable to measure the quantity of the current flowing under the same conditions.

To do this the current from fifty cells of battery was passed through a tangent galvanometer as a mere check or indicator of variations, and then through a copper voltameter, *i. e.*, a jar containing solution of cupric sulphates with copper electrodes immersed, and then through the lamp, placed in the photometer.

Under these conditions it was found that during an hour the light gradually varied from about 16 candles at the beginning to about 14 candles at the end, making an average of about 15 candles, measured with side loop of toward disk.

The galvanometer during this time only showed a fall of half a degree in the deflection of the needle.

Carefully drying and weighing the copper electrodes, it was found that one had lost 1·0624 grammes.

Now, it is well known that a current of one weber takes up 0·00326 gramme of copper per second, which would make 1·1736 grammes in an hour; therefore the current in the present case must have been on the average $\frac{1{\cdot}0624}{1.1736} = 0{\cdot}905$ webers, or a little less than one weber.

Having thus obtained the resistance of the lamp when emitting a light of 15 candles, namely, 76 ohms, and the amount of current passing under the same conditions, namely, 0·905 weber, we have all the experimental data required for the determination of the energy transformed or expended in the lamp, expressed in foot pounds. For this we multiply together the square of the current, the resistance, the constant 0·737335 (which expresses the fraction of a foot pound involved in a current of one weber traversing a resistance of one ohm for one second), and the number of seconds in a minute. Thus, in the present case, we have $0{\cdot}905^2 = 0{\cdot}8125$, and $0{\cdot}8125 \times 76 \times 0{\cdot}737335 \times 60 = 2753{\cdot}76$ foot pounds.

Dividing these foot pounds per minute by the number of foot pounds per minute in a horse power, that is, 33,000, we have 0·08, that is, about eight one-hundredths or one-twelfth of a horse power as the energy expended in each lamp.

It would thus appear that with such lamps as this, one horse power of energy in the current would operate 12 lamps of the same resistance with an average candle power of 10 candles each,* or 120 candles in the aggregate.

Assuming that a Siemens or Brush machine were employed to generate the electric current, such a current would be obtained, as has been shown by numerous experiments, with a loss of about 40 per cent of the mechanical energy applied to the driving pulley of the machine. To operate these 12 lamps, therefore, we should have to apply more than one horse power to the pulley of the machine, so that when this loss in transformation had been encountered there should be one horse power of electric energy produced. This would call for $1\frac{2}{3}$ horse power applied to the pulley of the dynamo-electric machine, by the steam engine.

To produce one horse power in a steam engine of the best construction about three pounds of coal per hour must be burned, and therefore for $1\frac{2}{3}$ horse power 5 lb. of coal must be burned.

On the other hand one pound of gas coal will produce 5 cubic feet of gas, and will leave, besides, a large part of its weight in coke, to say nothing of other "residuals," which will represent practically about the difference in value between "steam making" and "gas making coal," so that it will not be unfair to take 5 lb. of gas coal as the equivalent of 5 lb. of steam coal.

These 5 lb. of gas coal will then yield 25 cubic feet of gas, which, if burned in five gas burners of the best construction, will give from 20 to 22 candles each, or 100 to 110 candles in the aggregate.

We have, then, the twelve Edison lamps producing 120 candles and the five gas burners producing 100 to 110 candles, with an equivalent expenditure of fuel.

If each apparatus and system could be worked with equal facility and economy, this would of course show *something* in favor of the electric light; but when in fact everything in this regard is against the electric light, which demands vastly more machinery, and that of a more delicate kind, requires more skillful management, shows more liability to disarrangement and waste, and presents an utter lack of the storage capacity which secures such a vast efficiency, convenience, and economy in gas, then we see that this relatively trifling economy disappears or ceases to have any controlling importance in the practical relations of the subject.

* The candle power being 15 candles in the best position, and 5 candles at right angles to this, the average or general illuminating power of the lamp is 10 candles.

THE AMERICAN FISH CULTURAL ASSOCIATION.

The ninth annual meeting of the American Fish Cultural Association began in this city Marc 30. A large number of gentlemen interested in fish and fishing were present. The President, Mr. R. B. Roosevelt, read an interesting paper on hybrids. Mr. Seth Green contributed an account of his experience with California mountain trout, brook trout, and black bass at the State hatchery, with remarks on cray-fish and frogs.

Mr. Hugh D. McGovern submitted a short paper on the discovery made by him of a curious habit of eels. At the Brooklyn waterworks, among the wet moss growing on the crown of an arch over a waterway, 12 inches above the surface of the water, he found thousands of small eels, who seemed to live there, clinging to the moss as flies cling to the ceiling. The fact was important, as showing how this fish could move from water to water. To reach the moss these eels must have climbed up the 12 inches of wet wall above the surface of the water.

Mr. Livingston Stone, U. S. Assistant Commissioner of Fisheries, followed with an important paper on the transportation of live fish. Mr. James Annin gave an illustration of trout stripping in artificial propagation, using a number of male and female trout from his ponds on Long Island. Mr. Charles Hallock gave a description of Labrador fishing, and Mr. G. Lamphear read a short but valuable paper comparing the statistics of Fulton Fish Market for 1878 and 1879. His figures showed that 34,276,666 pounds of fish were sold in Fulton Market during the year 1879–'80, an increase of 646,700 pounds over the previous year. In addition, 1,509,561 mackerel had been sold and 291,845 shad.

The next day Prof. Brooks, of Johns Hopkins University, described the propagation of the oyster; and Prof. Atwater, of Wesleyan College, read a paper on the nutritive qualities of various kinds of fish. Prof. Brooks believes that the oysters of the Chesapeake do not breed in the same way as European oysters do; that the sexes are separate; and that to propagate oysters artificially the males and females should be chopped up together and thrown into the water, so as to thoroughly mix the eggs and milt.

In this way, he thinks, the oyster might be propagated with profit, using for the purpose small ponds. All this learned trifling will be very amusing to the practical oystermen of Connecticut, who, for a score of years, have successfully propagated oysters by the square mile. Their trouble is not to get an abundance of young oysters. At certain easily recognized times the Sound waters swarm with them, ready to attach themselves to any clean "stools" presented to them. The real trouble is to defend the oyster farmer's acres of partially grown oysters from the swarms of star-fish and other marine vermin which prey upon them; for which defensive work steam dredging seems to be the only economical and certain resource.

PHOTO-ENGRAVING.

In general terms the process of producing engravings or types for printing by photography, consists, first, in making a sharp negative of the picture to be engraved; second, in the photographic printing of a sheet of sensitized gelatine by means of the negative; third, the development of the printed lines upon the surface of the gelatine by water; and fourth, the casting of a copy of the developed gelatine sheet in metal, the metal so produced being used for printing on the press in the ordinary manner. All this is very simple, and in the hands of experienced and skilled persons very beautiful examples of printing plates, having all the fineness and artistic effect of superior hand engraved work, may be produced.

Among the earliest and most extensive efforts to introduce this process commercially were those of Mr. John C. Moss, of this city, to whose persevering labors the public is chiefly indebted for the successful establishment of the new industry in this country.

Mr. Moss has finally concluded to give the public the benefits of all his latest improvements in this line, by the organization of a new corporation known as "The Moss Engraving Company," whose first announcement will be found in our advertising columns. Every description of engraving and printing plates is done in a superior manner by the company promptly on very moderate terms. The Moss process has been used on the SCIENTIFIC AMERICAN, especially on our SUPPLEMENT, for several years past, and we therefore speak from experimental knowledge when we say that it is good and reliable. The motto of Mr. Moss's company is "The best work at low prices, always on time." In all our past experience with Mr. Moss, although we have given him many perplexing jobs, we have never known him to fail in carrying out the above motto. The Moss Engraving Company has a large and splendid establishment at 435 Pearl St., New York, which is fitted up in every department with the latest and best appliances for the execution of good work. It deserves and will doubtless command an extensive patronage.

THE NEW YORK EXHIBITION OF 1883.

A bill to provide for celebrating the one hundredth anniversary of the treaty of peace and the recognition of American independence by holding an International Exhibition of arts, manufactures, etc., in New York, in 1883, passed the Senate March 31. It incorporates the United States International Exhibition, composed of well known New York gentlemen, whose official functions are to continue until the close of the Exhibition. It will be their duty to fix the date of the Exhibition, make the needed preparations for it on a site within the corporate limits of the city of New York, and to superintend the Exhibition during its progress. The bill provides further that the corporation shall cease to exist on or before January 1, 1885. Congress may at any time alter or repeal the act, and the United States are not to be liable for any of the acts or representations of the promoters of the enterprise. Not less than $1,000,000 must be subscribed, and not less than 10 per centum thereof must be paid in before the corporation may do any corporate act other than organize, and no part of the capital stock or assets is to be withdrawn, refunded, or divided among the stockholders until all the debts are fully discharged.

Glucose Manufacture.

There appears to be quite a furor in the West in connection with the manufacture of glucose from corn. A large number of factories are being set up; one at Chicago, it is said, will have a capacity of 20,000 bushels a day. A bushel of corn produces 30 pounds of glucose (grape sugar) or 3 gallons of sirup. The sugar costs 2 cents a pound, the corn selling at 40 cents a bushel.

Artificial Atropine.

Up to the present time the artificial preparation of an alkaloid has not been successfully carried out. Vanilline and other organic products formed in plants have been made, and a substance isomeric with coniine was also made some years since. Ladenburg has recently taken an important step in the matter of making artificial atropine. He has, in fact, prepared the alkaloid, but the materials employed in its preparation, namely, tropine and tropic acid, have not yet been obtained from any other source than from atropine When atropine is acted upon by baryta or hydrochloric acid, it breaks up into tropic acid and tropine. To be able to unite these two bodies again, so as to form the true atropine, may seem a small affair, and yet it is often very difficult. Every one knows how grape sugar splits up into alcohol and carbonic acid, if yeast is present, yet no one has ever been able to convert alcohol into sugar by acting upon it with carbonic acid. The conversion of cane sugar into glucose is easy enough, and yet the opposite is impossible. The destruction of complex organic compounds is always easier than their production, and whenever we succeed in rebuilding a body from simpler ones we have made an important step in the direction of its synthesis. To decompose the tropic acid into simpler bodies, perhaps into substances that have already been prepared, and then to reverse the operation, will be the next duty of Dr. Ladenburg.

Atropine is the active constituent of belladonna, and possesses, with other properties, the remarkable power of dilating the pupil of the eye, whether introduced into the eye, taken into the stomach, or injected beneath the skin.

The artificial atropine prepared by Ladenburg has the same effect upon the eye. Both the natural and the artificial alkaloids possess the power of neutralizing the action of muscarine upon the heart. Physically they have the same melting points, and both crystallize in brilliant needles. The precipitates formed by tannin, mercurio potassic iodide, picric acid, chloride of gold, etc., have the same properties whether the natural or artificial atropine is employed. When heated with sulphuric acid and bichromate of potassium they each evolve an odor of benzoin These remarkable physical and chemical coincidences leave no reasonable doubt of their identity.

The Effect of Coffee Again.

Dr. Richardson, the eminent English scientist, in respect to the popular notion that coffee is an unhealthy beverage, that it keeps up a constant irritation of the stomach, and brings on depression of spirits, etc. There was a great deal of truth in that statement, says the doctor, as coffee cannot be taken in excess without producing dyspepsia and irritation, *but moderately used it is an invigorating, healthful, and wholesome drink, bringing a man's best energies into play.* The quantity taken, however, must not be large, and should be good.

Dr. Bock, of Leipsic, another celebrated scientist, says: "The nervousness and peevishness of our times are chiefly attributable to tea and coffee: the digestive organs of confirmed coffee drinkers are in a state of chronic derangement, which reacts on the brain, producing fretful and lachrymose moods. Fine ladies addicted to strong coffee have a characteristic temper, which I might describe as a mania for acting the persecuted saint. Cocoa and chocolate is neutral in its psychic effects, and is really the most harmless of our fashionable drinks."

Nerve Stretching in Obstinate Sciatica.

At a recent meeting of the Harveian Society, London, Mr. Pye read a paper on nerve stretching. A patient had suffered for many years with severe sciatica, for the treatment of which huge doses of morphia had been used. The patient was in severe pain when not under the influence of morphia. The nerve having been laid bare, it was pulled backward and forward, forcibly, with from eight to ten pounds pressure. The wound healed well, the pain was lost, and some paresis followed. The paresis wore off, and some pain was felt in the lower leg, but there was no return of the sciatica. The patient was able to resume work. The sciatica was probably rheumatic. The list of cases of nerve stretching yet performed is not large enough to settle the question of the justifiableness of the operation. Mr. Pye then reviewed very carefully the history of the operation. It has been less successful in the treatment of tetanus than neuralgia. When the nerve was compressed by an inflammatory area the operation promised well. In cases where the skin had become altered a change toward the normal condition followed, as well as the relief of pain.

Petroleum in Russia.

From an official report addressed by Colonel Românowsky to the Russian Minister of Finance, it appears that the principal petroleum depots in the Russian Empire are to be found in the southeastern and northeastern districts of the Caucasus, that is to say, in the province of Bakou, on the shores of the Caspian Sea, and in the province of Kouban, in the vicinity of the Black Sea. According to the statements of some Russian engineers, there are no less than 250 localities within these provinces where enormous quantities of petroleum can be found. It is said that 100 of these depots, if properly worked, could be made to yield 660,000,000 gallons per annum The Bakou oil is thick and heavy, suitable for heating and for rough purposes in general; the Kouban oil is of better quality for refining and for burning in lamps.

IMPROVED HAND AND POWER PRESSES.

We give on this page engravings of several varieties of presses made by the Boomer & Boschert Press Company of Syracuse, N. Y. These presses are adapted to a great range of work, such as baling cloth, pressing paper, expressing lard or tallow, making cider, wine, etc., and are built in different sizes to be operated by hand or power.

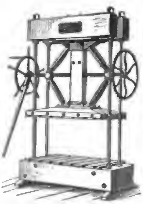


Fig. 1.—CLOTH BALING PRESS.

An almost endless number of devices have been used for obtaining pressure, the most prominent being the screw, the lever, and the hydraulic press, but these without exception give the same power at the beginning and end of the work.

In expressing lard and tallow or the different oils, as well as most other substances, but little power is required in the early part of the operation, and the constantly increasing resistance requires a corresponding increase of power. The construction of the Boomer & Boschert press is such as to insure a regular increase of power with every turn of the screw which tends to straighten the toggles, while the movement of the follower is proportionately less. The development of pressure and increase of resistance are so nearly equal that the same power that is applied at the beginning of the pressing operation is competent to finish. For example: one man with a hand power press can easily perform the task from beginning to end. This "progressive power," as the manufacturers term it, is perfectly adapted to the work, and by very simple means accomplishes wonderful results.

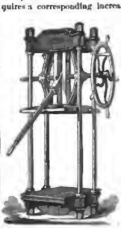


Fig. 2.—PAPER PRESS.

Fig. 1 shows a cloth baling press embodying this principle. The platen is guided by the rods which bind the upper cross beams to the bed and take the strain of the press. The frame and platen of this press are wood, and may be varied in size within certain limits without materially affecting the cost.

The paper press shown in Fig. 2 is made of iron in different sizes. The length of the rods controls the distance between the base and follower and the capacity of the regular sizes of this press may be varied by using longer or shorter rods.

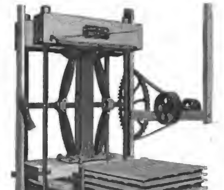


Fig. 3. POWER CIDER PRESS

The power cider press represented in Fig. 3 has a double platform, which is mounted on a truck, movable on a track on the floor. The shifting gear is worked by a crank, and is arranged to move the platform across the bed of the press easily and quickly. By means of this arrangement one cheese may be pressed while another is being made ready.

In this connection we give an engraving of Messrs. Boomer & Boschert's apple grater, which is very efficient and well adapted to the work it is required to perform.

The frame of the grater is made of iron, giving a security, strength, and stability which no wood frame, however well made, possesses. The cylinder is of iron, turned and carefully balanced. It has planed grooves to receive the knives—eight in number—which are adjustable by set screws, above and below at each end, and held firmly in their places by a heavy wrought iron band shrunk on each end of the cylinder

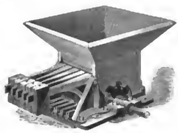


Fig. 4.—APPLE GRATER.

The concaves consist of five iron levers with movable weights, allowing stones or any other hard substances to pass through without injury to the knives.

Fig. 5 shows a press made on the same principle as the others and especially designed for kettle rendered scrap. It is provided with an improved hoop consisting of a cast iron section or post, which forms about one sixth of the hoop, is firmly bolted to the bed of the press, and arranged with hinges upon which swing two doors that complete the circle when fastened together. These doors are constructed of wrought iron hoops and staves, with steel fastenings.

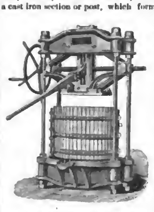


Fig. 5.—LARD PRESS.

When the pressing is completed, the doors are unfastened and swung open, the cake is removed, the doors are swung together and again fastened, thus avoiding much of the heavy lifting attending the use of other kinds of hoops.

These presses have been extensively introduced in the principal cities of this country—as well as Europe, South America, Mexico, and to some extent in Asia, and are deserving of the success they have attained.

Floating Island.

Among the many natural curiosities of Tuolumne county it is not generally known that there is a "floating island." Up in the "Siskiyous," lying like a pearl in the great mountain chain, is Squaw lake, a beautiful sheet of water, now utilized by a mining company as a reservoir. For many years the lake has been a favorite and delightful resort for fishing parties, and contained nearly in its center an island, comprising about an acre of ground, covered with luxuriant grass and a growth of willow and alder. It was never dreamed that the pretty little island was not terra firma, but when the bulkhead across the outlet of the lake dammed up its waters, the island rose slowly until it had been elevated fully 16 feet above its original level. It would be a question for the naturalist rather than the geologist to determine the age of this floating island, as it is evidently made up entirely of decayed vegetation. Perhaps at some remote period the roots of a tree, uptorn by the mountain storm, drifting out in the lake, formed the nucleus from which the island has grown, but it seems singular that it should have remained anchored and unchangeable in its position. The locality is much frequented by pleasure seekers who will hereafter notice the increased elevation.—*Jacksonville Sentinel.*

Home Made Soda Water.

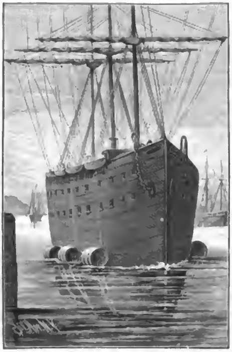
The artificial seltzer water, made with a carbonic acid generator, is already an imitation, far from perfect, of the natural water. A receipt to make it on the small scale for family use, as it were, can only give a product differing still more from that of the spring. Yet the following would fairly imitate the taste and properties of the natural water:

Fused chloride of calcium	4	grains.
Chloride of magnesium	12	"
Chloride of sodium	15	"
Citrate of iron	¼	"
Tartaric acid	2	drachms.
Bicarbonate of soda	2½	"
Water sufficient.		

Dissolve all the salts, excepting the tartaric acid and the bicarbonate, in about one pint of water, and introduce the solution into a champagne bottle. Then, having completed the requisite quantity of liquid so as to leave an empty space of about two fluid ounces, add the tartaric acid, and, immediately after, the bicarbonate of soda. Cork the bottle tightly, secure the cork with stout cord, and set the bottle aside for about six hours before it is opened. It is then ready for use.

NEW METHOD OF BUOYING VESSELS.

The annexed engraving represents a novel method of preventing the careening or rolling of vessels while discharging in port. Ordinarily vessels without ballast are supported by spars or logs; this improved method consists in attaching a line to airtight casks floating on the water at the sides of the vessel, and passing a line from each cask under the keel and up the opposite side of the vessel, where it is made fast. The casks employed for this purpose may be the ordinary water casks carried by all vessels. If one cask on each side is insufficient to produce the desired result two or more may be used. By this arrangement the least inclination of a vessel to roll is checked, and the cargo may be discharged without fear of careening.



WHEEDEN'S METHOD OF BUOYING VESSELS.

This device is adapted to pontoon bridges, floating docks, and may be applied to great advantage to disabled and leaky vessels at sea.

Further information may be obtained from the patentee, Mr. James C. Wheeden, 97 South Broadway, Baltimore, Md.

NEW CHECK-ROW, CORN PLANTER, AND FERTILIZER.

The machine shown in the annexed engraving is designed for planting corn in perfect check-row, so that the rows will be straight each way, and for delivering a limited amount of fertilizer to each hill.

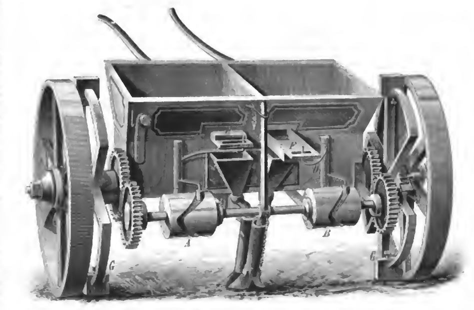
The running wheels and the markers, G, are mounted on a sleeve placed on a shaft which runs through the lower portion of the body of the planter. The markers, G, consist of three segments connected with a central hub, and having arc-shaped bars concentric with the running wheels and provided with feet or markers which, by indenting the ground, make an impression that serves as a guide for dropping the next row. As the relative position of these markers may at times require changing, they are connected with the arc shaped bars by clamp plates and bolts so they may be readily fastened at any desired point.

On the outer sides of the hubs of the markers there are ratchet wheels which are engaged by pawls carried by the running wheels, and the inner sides of the marker hubs carry spur wheels for driving the seeding and fertilizing devices. The pawls which carry the markers are provided with handles for easily operating them from the outside of the running wheels, and they are held either in gear or out of gear by a double acting spring.

A shaft carrying two grooved zigzag cams, A B, is journaled in supports projecting from the rear of the body of the planter, and is provided with spur wheels at each end which take motion from the wheels on the marker hubs. The cams, A B, are arranged to oscillate the rock shafts, C D, which, in turn, operate the feed slides, E F, which are so arranged as to drop seed and fertilizer into their respective hoppers, E being the seed slide, and F the fertilizer slide. In the seed slide there is the customary space for the reception of a few grains of corn which are to be dropped. This little chamber is pulled through the side of the seed box and allowed to drop into the hopper communicating with the spout by a flexible tube. To prevent the corn from becoming packed in the slide, the seed box is made with an expanding opening, which expands and allows the grain to pass without mashing it. The slide, F, is made adjustable so as to vary the quantity of fertilizer dropped with the seed. The grain spout and the fertilizer spout are connected together with the grain spout in advance, and they terminate in a plow or opener, behind which there are coverers.

The engraving shows the planter in its simplest form, adapted to a single row of corn, but it is obvious that a machine may be constructed on the principle to plant a number of rows simultaneously.

Further particulars in regard to this invention may be obtained from the patentee, Mr. H. F. Graetzel, of St. Joseph, Md.



GRAETZEL'S CHECK-ROW CORN PLANTER AND FERTILIZER.

John D. Napier.

Mr. John D. Napier, of the well known firm of Napier Brothers, manufacturing engineers, Glasgow, Scotland, died Friday, March 12. Mr. Napier was trained as an engineer by his father, the late David Napier, the pioneer of deep sea steam navigation in Great Britain. In early life he took a prominent position among the practical engineers of London. Subsequently he spent a number of years in Australia; but for a considerable period he had resided in Glasgow, ranking high among the leading mechanical engineers of his day.

Illiterate Collegians.

Mr. Charles Dudley Warner says, in the *Christian Union*, that he was told not long ago, by a professor in one of our leading colleges, that a freshman came to him, after he had been recommending certain books in the literature class, and said he had never read a book in his life. This was literally true. Except his text-books, he had never read a book; he had passed a fair examination, but of reading he knew no more than a Kaffir. Another professor in another college, also one of the highest in the country (both of these are Eastern colleges, in the center of the best culture in America) told Mr. Warner more recently that a sophomore, who stood well in his class, came to ask him where he obtained certain facts which he referred to in the class room. It came out that the young man never had read a book, didn't know what the sensation was, or how to set about it, and had not the faintest conception of literature. He had no notion of the pleasure or profit to be got from reading; the world of books was absolutely beyond his imagination, and he could not conceive what people found in it. The professor at length induced him to read one of Scott's novels, but the boy found it a very tedious and uninteresting occupation.

These two instances Mr. Warner thinks extreme only in degree, and insists that it is a common thing for undergraduates to be ignorant of everything but their text-books. There is a popular prejudice that young men who have been graduated at college are "liberally educated," and that no one else can aspire to that honorable title. Yet it is a common thing for untaught mechanics, used to reading good books and a paper like the SCIENTIFIC AMERICAN, to have vastly more real learning, and that of a more useful kind, than the average collegian carries away from college.

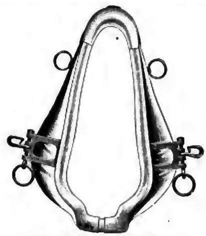
IMPROVED STEEL HORSE COLLAR.

We give herewith an engraving of an improved steel horse collar recently patented in the United States, Canada, Great Britain, France, Belgium, and Germany by Messrs. Fisher & Watson, and is being manufactured and introduced by Mr. R. Carter, of Brooklyn, N. Y.

This collar is swaged out of thin plates of steel, and is light, strong, and low priced.

A great difficulty has been encountered in attempting to provide metallic collars with suitable couplings or fastenings, which will not only connect the two halves or flanged sections of the same with the requisite security and rigidity, but also permit convenient adjustment, for the purpose of enlarging or diminishing the capacity of the collars, so as to adapt them for use on horses of different sizes, or on the same animals under different conditions. After many experiments Messrs Fisher & Watson have succeeded in producing a flanged metallic collar whose fastenings are of such a character as to permit easy and quick adjustment for varying width or length without weakening the connection and lessening the rigidity of the collar, and are at the same time light, compact, and durable.

With this collar no hames are required, as the traces are connected directly with the collar. It is perfectly smooth and hard, absorbing no perspiration, and cooling the shoulders by the hollow conformation, always exposed to the air; fitting closely to the neck and shoulders, all lateral motion is prevented, as well as any folding or creasing of the skin so often caused by the stretched or loose lining of the padded collar; it will never gall, and upon sore shoulders will exercise the same healing properties as the well known zinc pad. Further information may be obtained in relation to this invention by addressing Mr. R. Carter, 305 Quincy street, Brooklyn, N. Y.



STEEL HAMELESS HORSE COLLAR.

MISCELLANEOUS INVENTIONS.

Mr Ebenezar H. Sturges, of Wing's Station, N. Y., has patented a compact and convenient safe or receptacle for receiving and keeping housekeeping utensils conveniently and handy for use. It consists in a safe having compartments for knives, bottles, sugar, spices, and other articles.

Mr. Max Rubin, of New York city, has patented a bottle stopper provided with a discharge spout, and so constructed that the spout may be covered and uncovered by closing and opening the stoppers.

An improved store counter has recently been patented by Mr. Henry H. Henderson, of New Glasgow, Nova Scotia. The invention relates to means for supporting the hinged covers of the sections; and it consists in two jointed bars or rods, one pivoted on the inside and the other provided with an eye that slides on a keeper attached to the under side of the cover, in combination with a notched cam on the inside of one end of the section, so that the pivoted rod catches behind the shoulder when the cover is opened and holds it firmly in position.

Mr. John D. Richardson, Jr., of Newport, R. I., has patented an improved electric call bell. The object of the invention is to permit the operation from the central station of any one bell in the circuit, whereby one station may be called without giving an alarm at any of the others.

AMERICAN INDUSTRIES, No. 39.

THE MANUFACTURE OF PRINTER'S TYPE.

As there are nearly 8,000 newspapers in the United States, and probably twice as many printing offices for the production of every class of work from a merchant's card or letter head to a cyclopædia, it follows that the business of type-founding must be one of considerable magnitude. At first it was only a branch of the printer's trade, but it early developed into an essentially distinct business. Now a printer would no more think of making his own types than a tailor of weaving the cloth he cuts.

The forms of printing types and the manner of their use are so commonly understood that no account of them is needed here. The types with which all letter-press work is done must be uniformly "type high," which is a trifle over seven eighths of an inch. Of these types, a page such as this will contain about 25,000 separate pieces, counting the points, the spaces, etc., although, as "set up" by the compositor, the "spaces" between the words, the "leads" between the lines, the "quadrats" for filling out the blanks at the ends of paragraphs, etc., not being "type high," do not show in the print. Counting the capitals and small capitals, the italics, figures, punctuation and reference marks, etc., there are about 250 different pieces in every font of type, and all of these pieces must be kept in complete assortment for each different size of type, as well as for every different "face." There are, for instance, five different regular sizes of type smaller than that in which this article is printed, and in each of these sizes there are many different faces, even in the plain Roman styles, to say nothing of hundreds of kinds for ornamental work. These types have little nicks low down on the body of the metal, by which the compositor may readily see how to place them right side up, and a small groove is taken out of the bottom, so that each type, when composed in the page or column, will stand on its "feet," as they are called. It will be seen how exact must be the measurement and "fit" of each of these little pieces when it is remembered that, in the slight iron frame which holds them together in the pages of the largest newspapers, the pressure from the sides put upon the types, so that they will hold together in a body when lifted, is only just sufficient to overcome the weight of the metal. The types, thus set up in columns and pages, are ready for the press, except the work is of sufficient importance to have stereotype or electrotype plates made, in which case the types are used only to make the mould, and the printing is done from the plates. The Scientific American is printed from electrotype plates, which give a sharper and clearer impression, and will also allow of the printing of a much larger number of copies before showing wear on the fine lines of the engravings, than can be obtained from any stereotypes. The most of the large daily papers are now printed from stereotype plates. This improvement has been introduced within the past twenty years; the plates are necessarily made very quickly, and with many imperfections which would not be tolerable in fine work, but the making of plates greatly facilitates the printing of all large editions, for, the type being once composed, any desired number of plates can readily be produced. It is worthy of remark, however, that the general adoption of the practice of stereotyping their forms by the leading newspapers, and the copper-facing of the type, whereby the wear of the letter is greatly extended, seemed to have hardly any effect on the business of type founders; the demands for larger quantities and a greater variety of type have grown so steadily that even these great improvements did not appear to diminish the call upon the founders.

We have in the preceding three numbers sketched the manufacture of power printing presses, book paper, and printers' ink, and, for our illustrations in this paper of the manufacture of printer's type, so naturally associated with the above, and completing this class of industry, we show the leading operations in the large type foundry of Messrs. Farmer, Little & Co., of New York, a firm employing from 175 to 200 hands in the business, and making all descriptions of printer's plain and ornamental types, borders, rules, dashes, etc., besides making their own type-casting machines, steel punches, matrices, etc.

The large view at the bottom shows the main type-casting room, which occupies the entire top floor of the large six story building, 63 and 65 Beekman street, seen in the central picture. The machines for casting are most of them ranged around near the windows, to give the best of light, which is very important. The machines only take up about as much room each as a sewing machine. Each one of them has a little coal-burning furnace for melting the type metal, and about a quart of the molten metal is held in an open reservoir at the top. Though these machines are sometimes operated by power, the advantage of so doing is by no means clear, for there must be so many stoppages in doing careful work that but little can thus be gained. The operator turns a crank, which brings the mould up to a little spout projecting from the pot, from which the metal is forced into the mould, when the latter flies back and automatically drops its type, this operation being repeated with every turn of the crank. Care must be taken that neither the metal nor the mould get too hot, and the mouth of the spout must be frequently cleaned of refuse metal not taken in by the mould.

The type casting machine was first successfully operated in this country about 1840. By its use type are cast fully fifty per cent cheaper than they were by hand. The speed at which it may be run varies according to the kind of type, the plain newspaper types coming from the machine as fast as 100 or more a minute, while the ornamental types and all larger job types have to be cast a good deal slower. In the latter case a perceptible interval has to be allowed for the hardening of the metal in the mould, which, with the smaller types, is instantaneous; and in all scripts, where a portion of the letter extends over the body, the work has to be done slowly to prevent these parts from being broken off.

In the view at the upper left hand corner may be seen the work of dressing and finishing the types after they come from the casting machine. Each one, as it drops from the mould, has a little jet or ingot of surplus metal attached to the foot; these are broken off singly by boys, when men rub the broad sides of the types on stones to remove any roughness on the edges; where the metal has to be dressed out around a face projecting over the body, workmen of a different branch are employed, called kerners. After this the types are arranged on long rules or dressing sticks, in lines three feet long, and, each line being firmly fixed in a kind of metal planer, a cutter is passed over the edges, to make them perfectly true. A light scraping is then taken off the body of the type next the face, and a groove is run through the bottom, where the little jet or ingot of surplus metal had been broken off, and making the "feet." This work is all done by the piece, the castors, dressers, and finishers being all paid so much a pound, according to the size and kind of type.

CASTING TYPE.

The right view at the top shows where the steel dies or punches are made, and where the types, as they come from the finishers, are divided up into the proper allotment of letters and sorts for each different font. Type founders take orders for fonts of all sizes, but in the making of plain body letter it is usual for them to arrange all that is necessary for a complete font in a "scheme" for about 300 or 600 pounds, and then, when any smaller amount is ordered, divide up the type proportionately. Before this work is done, however, the types are all carefully examined with magnifying glasses to see whether any imperfect or defective letters have been passed by.

The letter engraving, which is also shown in this view, consists entirely in cutting the dies on steel for the face of the letters. Soft bar steel is used, which is hardened after the cutting, and all the work is done by hand. These dies are used for making matrices, in copper, to place in the moulds for the different faces required. These matrices are struck out of a piece of copper weighing at least three times as much as they do when finished, and then worked down, so as to insure the greatest exactness.

In the illustration at the right in the middle, is shown the department where the type-casting machines are made, and where the matrices and moulds are severally adjusted. There are a good many pieces required in the mould for casting a type no larger than a pin, and these, while being constantly subjected to a pretty high temperature and wearing usage, must be kept as true and exact as the works of a fine watch.

In the same room also may be seen the work of making brass rules, which are always used between the columns of type in newspapers, and for the dashes between articles, etc. The sheet brass used for this purpose is furnished by the brass manufacturers cut in strips of proper width to allow of facing, and of the required thickness. The facing and finishing of these to make ordinary newspaper rules is done with planers, by hand, but for making wave rules and ornamental dashes, different kinds of steel cutters are used. Here also the "leads" and "slugs" are made. The former are thin strips of type metal, cut to the width of the column, and placed between the lines of type when it is desired to give the printed matter a clean and open appearance. This page is leaded, with perhaps two leads between the head lines, and a thin slug between the rule at the top of the page and the first line of type.

In the illustration at the left, in the middle, is shown the process of electroplating, with copper, the illustrations, newspaper headings, etc., made by the firm. The copper will give the finest lines, and is much more lasting than type metal. The thickness of this coating varies according to the work, or as may be desired, from [illegible] to $\frac{1}{16}$ of an inch.

There are five kinds of metal used by type founders generally, according to the particular work in hand. These all consist of different proportions of lead, copper, tin, and antimony. Though many other combinations have been recommended, and used to some extent, these are the only metals generally and successfully employed. The quadrats, which correspond with the white spaces in the printed page, and on which the least wear comes, are made of the cheapest metal, the smallest types, on the other hand, require the hardest, toughest, and dearest metals, while the medium-faced types, such as would be used in ordinary books, have a grade of their own, as have also the ornamental job types and the script. Messrs. Farmer, Little & Co. have always paid particular attention to this department of their business, and can point with satisfaction to the long continued use their fonts have withstood.

The want of accuracy in the justification of type would be a fault for which all other good qualities combined could not atone. To secure this, however, only the best of machine work must be employed in the fitting of the moulds and the finishing of the matrices, as well as in the dressing and finishing of the type; and in this branch of the business the complete appliances and experienced workmen, the firm have, afford the best of evidence that, by properly appreciating its importance, they have won the right to claim special excellence in this direction.

The number of "new faces" which any type foundry will get out in a given time depends largely on the state of general business. The firm of Farmer, Little & Co. have always been fully up with the times in this kind of enterprise, and some of their styles of type, both plain and ornamental, as well as their very elaborate combination borders, are to be found in almost every considerable printing office in the land. It is as difficult for a really good printer to see a nice new face of type without buying a font of it as it is for a fashionable lady to do without the latest style of bonnet. But in the variety this house can present of types they have originated in their long business career, they have an advantage which only an old foundry can offer.

The house was established in 1810, and since that time they have been constantly accumulating dies and matrices, which always constitute the most valuable portion of the stock of a type foundry. Of the present members of the house, it can be said that they are all active workers and practical men in their trade, the senior of the firm having been about fifty years continuously connected with the business.

Signaling Instruction.

The spring signaling instruction has commenced at Fort Preble, an hour's drill each day. For this army system of signaling is claimed superior simplicity over all others, its advocates claim preference for it over the Morse alphabet, and certainly its messages are more easily transmitted by ordinary appliances. No sailor ignorant of a code should be allowed to go to sea in any capacity of command. Magnetic telegraphs and Edison telephones are well enough in their place, but a ship on a lee shore needs its officers and the coast guard to be well instructed in Myer's Code. It should be taught in all our schools. We give the alphabet below for the benefit of the curious. The second columns are the equivalents for which the corresponding letters may serve as contractions. With four of any two kinds of things, fixed signaling can be done. Calling one's right side one, and his left side two, he can transmit any message by waving a handkerchief according to the following table.

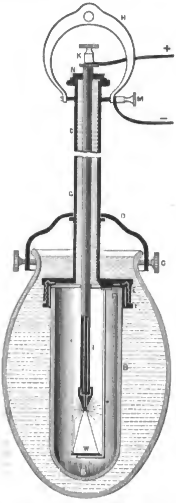
Letters.	Word Equivalent.	Signal Number.	Letters.	Word Equivalent.	Signal Number.
A	after	22	P	put	1212
B	before	2112	Q	quiet	1211
C	can	121	R	are	211
D	did	222	S	station	212
E	of the	12	T	the	2
F	for the	2221	U	you	112
G	ground	2211	V	very	1222
H	have	122	W	wood	1121
I	if the	1	X	next	2122
J	———	1122	Y	why	111
K	o'clock	2121	Z	———	2222
L	———	221	&	———	1111
M	———	1221	ing	———	2212
N	not	11	tion	———	1112
O	of	21			

If we have four apples and four oranges, and we designate the apples ones, and the oranges twos, with them then we can spell out anything. Thus to spell the word *system* we would from our right to left (so that they may come in regular order for the reader) first place an orange, then an apple, then an orange (= 212 = S); after withdrawing the S place an apple, an apple, and an apple (= 111 = Y); next repeat the S (an orange, an apple, an orange), next place an orange (= 2 = T), next an apple and orange (= 12 = E), and last an apple, an orange, an orange, an apple (= 1221 = M).

With a small flag a sweep to the left, two to the right, and one to the left would spell *be*. A great many contractions can be made and are introduced in the code.

THE ANDRE-BROUGHAM ELECTRIC LAMP.

In the annexed engraving is a representation of an electric light invented by Professor André, who, with the assistance of the Hon. R. T. D. Brougham, has devised a lamp which is said to be very efficient. We take the following description from the *Engineer:*



THE ANDRE-BROUGHAM ELECTRIC LAMP.

The value of the improvement will at once be seen when we state that it reduces the carbon consumption to about 0·135 in. per hour, while a similar carbon burnt in a lamp open to the atmosphere burns about 6 in. per hour, the cost in carbons being thus reduced to 1-48th of what it would be in an ordinary lamp. This is, probably, a maximum reduction, inasmuch as the carbons in ordinary lamps are of a larger diameter, those used in the André-Brougham lamp being only 2 mm. diameter.

The improvement consists in surrounding the lamp, or a portion of it, with a separate vessel of glass containing water or some other suitable liquid. In the accompanying diagram, B B B is the glass globe of the lamp proper, A A the surrounding vessel containing the liquid. The shape of these vessels is immaterial. It may, perhaps, conduce to simplicity if the lamp is first described. Two concentric tubes (G G, I I I) are separated by a non-conductor, such as plaster of Paris. These tubes are connected to the two terminals of the battery by the binding screws, K M. The outer tube, G G, is in electrical contact with the pyramid shaped piece of metal, W. The inner tube, I, contains the carbon rod, which rests upon the metallic wedge and falls down by its own weight, and that of a small weight placed on the top of the carbon, but within the tube. No doubt the light is due partially to incandescence of the carbon, and partially to the formation of an arc. The cap, N, on the top of the tube, G G, through which the inner tube passes, is of vulcanite or other non conducting material. Round the top of the lamp globe, B B B, is a metal cylinder to be screwed into the corresponding cylindrical E¹ E¹. The ring, E E, has a sharp edge at the top, while E¹ E¹ has a corresponding recess. Between the two is an india-rubber washer, F F, so that on screwing E E the India rubber is jammed into the recess in E¹ E¹, and a good water-tight joint made. The lamp is fitted with a cap, D D, to which, by means of binding screws, C C, and clamps, the vessel, A, is fixed. This vessel is partially filled with water or other liquid, so that when in its proper position the liquid rises above the cap, E¹, thus rendering the permeation of air into the lamp an impossibility. So long as the liquid in A is above the cap, E¹, no atmospheric air can enter the lamp globe, B, a tight joint is obtained, and at the same time the heat from the lamp is carried off or dispersed, and the light more or less diffused.

Late Development of Sugar in Sorghum.

Dr. Collier, chemist of the Agricultural Department, explains the frequent failure of sorghum to yield a profitable quantity of crystallizable sugar by the results obtained by his experiment last year. His Chinese sorghum, for example, attained its growth, and to all appearance was ready for the harvest on the 6th of August; but an experiment on that date resulted in getting only one and eighty-five hundredths per cent of crystallizable sugar, with about five and fifty-five hundredths of glucose or uncrystallizable sugar, while three weeks later the percentage of crystallizable sugar had reached twelve and fifteen hundredths per cent, and the uncrystallizable matter was only three and forty hundredths per cent. This species of sorghum reached its maximum for profitable production on the 14th of October, on which date the percentage of crystallizable sugar was fifteen and five hundredths per cent of the weight of juice expressed.

Experiments with the early amber, the variety best suited to this latitude, began on the 18th of July, giving a result of four and forty-three hundredths per cent of crystallizable sugar, with three and seventy-seven hundredths of glucose. The percentage of crystallizable sugar rapidly increased until the middle of August, when it exceeded fourteen per cent. There was very gradual increase until the 29th of October, when it reached seventeen per cent of the juice expressed, the uncrystallizable sugar on that date being only one and ten hundredths per cent.

About a week previous to this date there was a severe frost, and cold weather continued for several days. During the time stalks were cut and experiments were continued, showing that the frost had no bad effect upon the crop. When a thaw came, however, the effect was immediately apparent in the rapid decrease of valuable matter and increase of worthless matter in the juice; and this effect was noticed in all varieties of sorghum. The inference, as drawn and stated by Dr. Collier, is as follows: "Let your crop stand as long as you can; but if a frost catches you before it is gathered, hurry up and get it squeezed before a thaw comes."

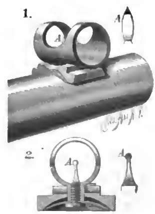
The Moss Industry in Louisiana.

The New Orleans *Times* says that the moss industry of that region has quite recovered its former flourishing condition. The moss is mostly gathered by negroes. Cypress moss is preferred, as it is the longest and most tenacious of all the varieties. After the moss is gathered it is placed on a sunny spot, and left a month to the action of wind and weather. At the end of that time the grayish bark peals off, leaving the hair almost clean. Some of the moss requires no manipulation, while other assortments are, in weight, more than half dirt. After being thus dried the material is sold to the plantation storekeeper or to the cross-roads groceryman, and the gatherer receives from one to two cents a pound for it, according to its quality. The stuff is baled and sent to New Orleans for manufacture. After the moss reaches the factory it is subjected to the action of the washer, which is a large cylindrical arrangement with a wheel inside, which pulls the moss hither and thither, and dashes it through a vat of boiling water and soap, until the stuff is cleaned. Then it is hung out upon the racks to dry. This done, it is put into the duster, a fan mill, which entirely removes all the dust that may have survived the washing process. The moss comes into the factory yellow in color and goes out inky black. The article is then made up into bales, according to quality, and lettered with single, double, treble, and quadruple X's. The highest grade, XXXX, can hardly be distinguished from the finest and choicest horsehair. The other grades are consumed mostly in Louisiana. Seven years are required for the growth of a crop of moss after a tree has been stripped.

NOVEL SIGHT FOR FIREARMS.

The annexed engraving shows a new combination sight for firearms recently patented by Mr. O. D. Warfield, of Chicopee Falls, Mass. The invention consists in arranging its tube or cover of the sight so that it may be turned around on its base in such a manner that while in one position the sight or bead is seen by looking through the tubes the same as in an ordinary covered sight, and when turned in the other position the point of the sight is exposed uncovered.

Fig. 1 shows the sight attached to the barrel of a gun and turned so as to show the point of the sight, A. The shape of the sight as seen in this position is shown in the small detail view above the end of the barrel. The appearance of the sight when turned into the other position is shown in Fig. 2.



IMPROVED SIGHT FOR FIREARMS.

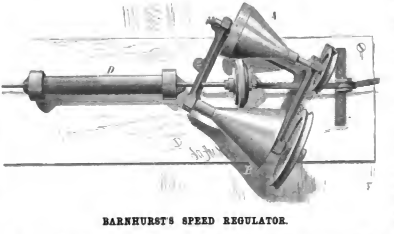
The tube which incloses the sight is held in either of its positions by concaves formed in the base piece at right angles to each other. The spring under the base draws the tube down into the concave and holds it accurately in position.

NOVEL SPEED REGULATOR.

The engraving shows a new combination of mechanism for regulating the speed of sewing machines and other light machinery. It consists of two conical drums, A B, journaled in a rectangular frame, with their larger ends oppositely arranged and their contiguous faces parallel.

A friction wheel, C, is placed between the two conical drums and journaled in a support attached to the end of a rod passing through the spring barrel, D. The shafts of the conical drums, A B, each carry a pulley, one to be connected by a belt with the motor, the other to be connected with the machine to be driven.

A cord is attached to the support of the wheel, C, for drawing it along between the drums, A B, so as to communicate motion from different portions of driving drum to different places on the driven, and thus vary the speed, making the speed of the driven drum either faster or slower than the driver.



BARNHURST'S SPEED REGULATOR.

The bearing surface wheel, C, is made of rubber or similar material, and as it becomes compressed or worn, the difference in diameter is compensated for by moving the drum, A, longitudinally on its shaft.

The base of the cone, A, is cut away as shown, thus permitting the traveling friction, C, to stop the machine by disengagement.

This device is capable of controlling any speed within reasonable limits from 1 to 1,000 or 1,200 revolutions per minute. It can be used to stop and start, which it does instantly.

With this regulator when the speed is reduced the power is correspondingly increased, so that when a slow motion is transmitted it is with a great deal of force. This feature will prove particularly useful in that class of motors that obtain their power from the multiplication of small impulses, as in the case of small electrical or water motors.

Further information concerning this useful invention may be obtained by addressing Mr. H. R. Barnhurst, Erie, Pa.

Water System of New York.

During the past four years the Department of Public Works has added to the Croton Water Service 70 miles of distributing pipes, making the present extent of pipes 480 miles. The Croton aqueduct supplies 95,000,000 gallons a day. The elevated railroads consume over half a million gallons daily

NEW PETROLEUM FIELDS.—It is reported that petroleum has been discovered in large quantities in the vicinity of Lake Ainsley, Cape Breton; also in Alabama.

AGRICULTURAL INVENTIONS.

Mr. William B. Garoutte, of Republic, Mo., has invented a novel cotton and seed planting machine. This improvement relates to machines for forming a mould or ridge, dropping the seed along the ridge, and covering the seed.

Mr. William L. Dietz, of Schoharie, N. Y., has patented an improvement in scrapers and cultivators for broom corn, cotton, and other plants planted in rows and drills, so constructed that they may be readily guided to operate upon crooked rows and may be conveniently turned at the ends of the rows.

IMPROVED PIPE TONGS.

The annexed engraving represents an improved pipe tongs manufactured by Messrs. Noble, Hall & Co., of Erie, Pa. The handles are pivoted on the usual rivet, which extends also through check-pieces attached to one of the handles. This construction gives a firm bearing to the pivot, and avoids the twisting motion which is usually so destructive to the tongs. The check-piece has a rectangular recess formed in it for receiving a cube of hardened and tempered cast steel. This cube is always held with one of its corners toward the center of the tube, whether the pipe being turned or held is large or small. It will be noticed that the steel cube has twelve available corners, so that as one becomes dulled by use another may be put into position for work. The cube or bit is held in its socket by a tapering pin extending across the mouth of the socket.

After the cube becomes worn on all of the corners it may be sharpened by grinding and replaced with enough backing to compensate for the metal ground away; and after it is worn so that it is incapable of further use it may be replaced by a new one at a slight cost.

One of the jaws is made adjustable by a thumbscrew to adapt the tongs to different sizes of pipe. This firm make also tongs of the same general character without the adjustable jaw. The manufacturers claim that for strength, durability, simplicity, and cheapness these tongs have no equal in the market.

THE ACME CUBE PIPE TONGS.

ICE-MAKING APPARATUS.

The accompanying engraving represents an ice-making apparatus designed and constructed by the Boyle Ice Machine Company, of Chicago, Ill., who are the patentees and manufacturers of ice machines and refrigerating apparatus.

The engraving shows a one-ton ice machine. On the left is seen a steam boiler and a combined engine and ammonia pump; in the center a pump for water supply for gas condenser, and on the right a freezing tank. The ammonia pump is used for compressing the ammonia gas which is liquefied in the condenser, and is expanded in a freezing tank seen at the right in which the cold is produced.

The freezing tank where the ice is produced is provided with coils of iron pipe, in these the gas evaporates, and they are placed at regular spaces apart, the spaces being regulated by the thickness of the ice required. Between the coils are placed moulds or cans containing the water to be frozen, and the space about both moulds and coils is filled with strong brine.

The operation of the machine is as follows: The pump being put in motion, a valve leading from the condenser to the evaporator coils is opened and the liquid gas flows into the evaporator coils. There, meeting with the heat in the salt water to be cooled down, it expands very rapidly, taking up the heat which is in the brine, which, in turn, extracts the heat from the water in the moulds. The expanded gas is aspirated by the pump and forced over into the condenser, where the heat is taken from it by a stream of water continually flowing over it, and under the pressure of the pump is reliquefied, and returns again to be expanded in the evaporator coils.

This process is continued until such time as the water may be frozen, when the mould is lifted from its place in the freezing tank and immersed in warmer water, which loosens the ice from the mould, when it is readily removed; and the mould, being refilled with water, is again returned to the freezing tank.

The ammonia pump (patented by the Boyle Ice Machine Company) is single acting, and works with regularity and smoothness; no water is required in order to keep its piston rod cool, and the pressure on the stuffing box never exceeds fifteen pounds to the square inch, avoiding all trouble in keeping the stuffing box tight and leakage of ammonia.

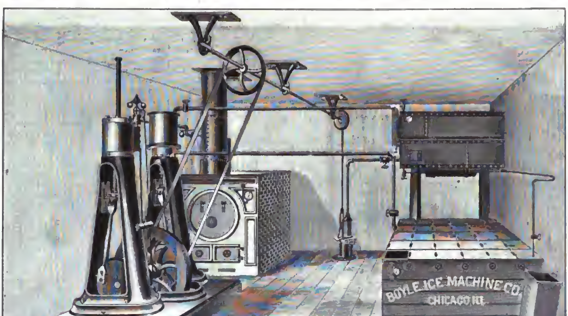
In making a calculation of the entire expense of operating a machine of any size, there should be an allowance made for the oil used in lubricating the engine, and for the expense of ammonia. An allowance of fifty cents per day for the smaller sized machines, and of one dollar per day upon the larger sized machines, would be ample for this item.

It is claimed that repairs would not ordinarily amount to one per cent per annum upon the cost of the apparatus. Calculations by this company for the production of ice and for all expenses connected with the operating of a complete ice factory are upon the conditions incident to the hottest weather in the South; and in a more temperate climate, with cool condensing water, the expense for fuel would be decreased considerably, as well as the supply of water necessary for condensing the ammonia.

Machines with which ammonia is used as the necessary refrigerant have proved to be among the best and the most efficient machines for the purpose; they are not liable to explosion or causing fire.

The machines referred to are of a simple character, have few parts, and are easily managed by any mechanic of ordinary intelligence. Their efficiency and reliability, their durability and inexpensiveness of operation, the manufacturers state, are beyond all question, as certified to by several extensive manufacturers and professional experts.

Further information and circulars containing full details of construction and mode of operation, and testimonials from parties using these machines, may be obtained on application to the Boyle Ice Machine Company, No. 10 North Jefferson street, Chicago, Ill.



BOYLE ICE MACHINE.

Straightening Hardened Steel.

In hardening and tempering tools they sometimes spring, to the great annoyance of the workmen, and not seldom the tool is reheated and rehardened. In most cases this may be avoided. To straighten a piece of steel already heated and tempered, heat it lightly, not enough to draw the temper, and it may be straightened by blows from a hammer, if the character of the tool will admit of such treatment, or, as in case of a tap, it may be straightened by a heavy mallet on a hard wood block. Although the steel when cold would break like glass with this treatment, when slightly warmed it will yield to moderately heavy blows uninjured.

ENGINEERING INVENTIONS.

Mr. Harry M. Sciple, of Selin's Grove, Pa., has patented a portable steam engine combining the features of lightness, durability, and cheapness. The invention consists in a vertical steam engine having the base, column, pedestal, cylinder, and steam chest cast in one piece and fitted with the cylinder head and crosshead guides, that are cast in one piece, whereby the required strength is obtained, and there is but a single joint to be fitted.

An improved signaling apparatus for railroads has been patented by Messrs. Richard B. Ireland, of Trenton, and William H. McDonald, of Newark, N. J. The object of this invention is to provide for operating a signal located at one point on a railroad from different places—say from two separate switches—in such manner that the signal shall be exhibited when either switch is open and until both are closed, or so long as the main line is not clear.

Mr. Hiram N. Wickes, of Grand Gorge, N. Y., has invented an improved car coupling that couples automatically without requiring any one to step in between the cars, the link being held in horizontal position, so as to secure its entrance into the opposite drawhead. The invention consists of a drawhead, with internal cavity having upwardly inclined rear portion and central guide rib, along which a centrally grooved roller is carried by the link.

Mr. Jean L. Nevers, of Pass Christian, Miss., has patented a water and wind mill, which the inventor calls a "wing motor." It is simple, automatic in the adjustment of its sails, and capable of utilizing a large percentage of the power of the wind and current of water.

Mr. Richard B. Ireland, of Trenton, N. J., has patented improvements which relate to signaling apparatus used in the "block" system of signals for the movement of trains, in which system the road is divided into sections or blocks, with a signal station between each block, and no train allowed to pass a station without a signal from the operator. Heretofore there has been great liability of the engineer mistaking the signals; and the object of this invention is to prevent such mistakes, which is accomplished by giving to the signals a definite form and position, either of which will indicate, in addition to the color, the exact character of the signals. The inventor states that the apparatus may be worked in connection with two or more switches with one wire and one slide.

Mr. Stephen B. Segur, of Gold Hill., Nev., has patented an improved hoisting device, the object of which is to prevent hoisting cages in mines or elevators of any description from being raised so high as to endanger the lives of miners or others working in connection with hoisting apparatus or being carried up by elevators. The invention consists in a safety hook of novel construction and in means for detaching the same from the elevator car.

Mr. Henry Case, of Brooklyn, N. Y., has patented a composite pile for submarine foundations and other purposes that shall withstand decay or the attack of worms and insects better than a wooden or iron pile.

Mr. Albert Bonzon, of Santiago, Cuba, has patented a new attachment for the second-hand shaft of clock or watch works which will cause the second hand to beat seconds, and which is so arranged that these beatings of the second-hand can be interrupted or started at any desired moment.

CAPTURE OF A LARGE FINBACK WHALE.

We publish herewith a picture of the large whale now on exhibition in this city. It was captured on March 16, two miles off Provincetown Harbor, Cape Cod, by a whaleboat's crew of five fishermen, armed with a bomb lance and gun. He was purchased from his captors by Swift & Co., of Provincetown, for $600, and towed to this place by the tug Charles Lawrence, requiring four days and nights for the passage. Arrived, the monster was floated on a drydock, and has since been viewed by thousands of people.

The back of the whale is hard and shines like ebony; the belly is white like ivory, and where the two meet at the sides it takes a slaty gray tint.

A series of wrinkles, as if scored by fire, run backward and upward from beneath the jaws like bilge keels on a vessel. The skin beneath the eye is also wrinkled in massive folds. The flesh, where exposed by scars or wounds, is red and firm like beef.

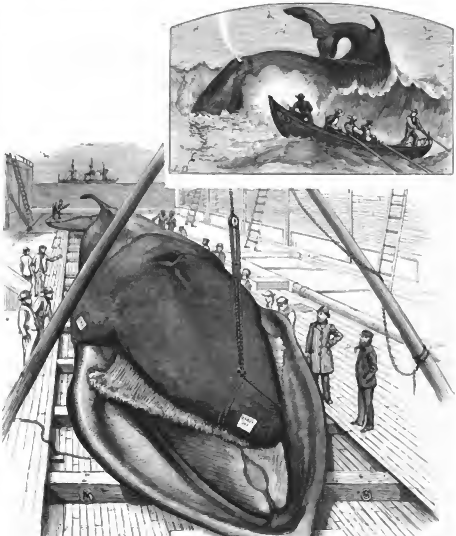
The head forms one quarter of its length. The body is 65 feet long, 15 feet in greatest diameter, and weighs about 70 tons. The eyes are very small, set a few inches back of the jaw socket. The spout hole crowns the summit of the head, 17 feet back from the nose, surrounded by a three-cornered ridge of bone and India rubber-like flesh. The tail is flexible, forked like a broad-arrow head, set sideways to the body, enabling the whale to dive quickly. From behind the eyes project two broad soft fins, and a little one springs from the sharp ridge near the tail, giving it the name finback.

The upper jaw is long, narrow, and concave, the edges smooth and rounded. In place of teeth there extends downward a whalebone formation like the teeth of a huge comb set obliquely, growing in size from a few inches at the nose to three feet or more at the jaw, the whole terminating in a stiff broom-like fringe of bristly hairs.

The lower jaw is entirely smooth, much wider than the upper, the latter fitting down into it like a cover, the bone fringe filling up the groove and serving as a strainer through which the water is expelled after a school of small fry is ingulfed in the maw. The tongue covers the entire inner surface of the lower jaw.

The orifice of the ear is hardly perceptible, yet the hearing is so acute that a ship crossing its track a half mile distant will cause it to dive instantly.

This species of whale is the most dangerous to attack, and the least profitable. It destroys vast numbers of small fish, and is worth only $500 for oil and bone. It fights desperately, and if badly wounded describes a large circle having a "swath," inside of which he makes his last stand, and woe to anything that ventures in. If left alone there he will die quietly, announcing his death by elevating his fins and turning his head toward the setting sun.



CAPTURE OF A LARGE FINBACK WHALE.

The Phylloxera Pest.

To compensate for their discomfort during the past almost unprecedented cold winter, the people of Southern France had hoped that it would result in the killing of the above insect pest, which has for the last few years been so destructive to their grape crop. But from the observations with regard to this made by M. Lichtenstein, he arrives at the lamentable conclusion that the phylloxera has not experienced the least harm from the temperature of ten to eleven degrees below zero. This applies not only to the insects deeply interred, but even to those near the surface. M. Lichtenstein found a number of other pucerons similarly resistent to cold. These little creatures, attached to the aerial parts of the plants which they attack, were completely benumbed and torpid, but after being transferred to the laboratory they proceeded with their hatching operations as if nothing had happened.

The Edible Sea Worm.

There is a very curious food product obtained in the Pacific, which is esteemed as highly as are whitebait in England; it is a small species of sea worm, a genus of annelids, known scientifically as *Palolo viridis*. The following account of it is given by a traveler. These worms are found in some parts of Samoa (Navigator Islands) in the South Pacific Ocean. They come regularly in the months of October and November, during portions of two days in each month, namely, the day before and the day on which the moon is in her last quarter. They appear in much greater numbers on the second than on the first day of their rising, and are only observed for two or three hours in the early part of each morning of their appearance. At the first dawn of day they may be felt by the hand swimming on the surface of the water; and as the day advances their numbers increase, so that by the time the sun has risen, thousands may be observed in a very small space, sporting merrily during their short visit to the surface of the ocean. On the second day they appear at the same time and in a similar manner, but in such countless myriads that the surface of the ocean is covered with them for a considerable extent.

On each day, after sporting for an hour or two, they disappear until the next season, and not one is ever observed during the intervening time. They are found only in certain parts of the islands, generally near the openings of the reefs on portions of the coast on which much fresh water is found; but this is not always the case. In size they may be compared to a very fine straw, and are of various colors and lengths, green, brown, white, and speckled, and in appearance and mode of swimming resemble very small snakes. They are very brittle, and if broken into many pieces, each swims off as if it were an entire worm. The natives are exceedingly fond of them, and calculate with great exactness the time of their appearance, and look forward to it with great interest. The worms are caught in small baskets, beautifully made, and when taken on shore are tied up in leaves in small bundles, and baked. Great quantities are eaten undressed, but either dressed or undressed they are esteemed a great delicacy. Such is the desire to eat "palolo" by all classes that immediately the fishing parties reach the shore, messengers are dispatched in all directions with large quantities to parts of the island in which none appear.

Many of the European residents in the Fijis eat the "palolo," and look on it as quite a periodical relish. It also makes its appearance in the New Hebrides, in Tongo, and in the Samoan or Navigator Islands identically with its advent in Fiji.

The Hittites.

One of the most interesting parts of Chief Justice Daly's annual review of recent progress in geographical exploration, before the Geographical Society, March 18, was that touching the important discovery of the seat of empire of the ancient Hittites. Judge Daly said:

The readers of the Bible will remember the frequent mention that is made of the Hittites, a people occupying Canaan, who are described in the biblical narrative as being commercial and military, and in whose country Abraham bought a piece of land for his burial place. The scattered accounts in the Bible simply indicate an ordinary tribe of people, with whom the Israelites had intercourse, but information derived from the researches made in Egypt and Assyria show that the Hittites, whom the Egyptians called the Kheta and the Assyrians the Khatti, were a powerful confederacy occupying the country which was the highway between Babylonia or Assyria and Egypt—a people actively engaged in commerce, their principal city being a place to which merchants from all parts congregated, and who were at the same time a warlike people, who for a long period kept the Assyrians in check, and who proved the most formidable antagonists the Egyptians ever encountered. They were not only commercial and warlike, but had evidently at a remote period made great advances in civilization and in the fine arts and early Greek art, as found in the discoveries of Dr. Schliemann at Mycenæ; and the early art found in Cyprus by our associate, Mr. Di Cesnola, is supposed to have been largely derived from them.

They occupied the whole country of Southern Syria, from the Mediterranean to the desert, dwelling chiefly in the fertile valleys of the Orontes, a river rising to the east of Baalbec and flowing into the Mediterranean, and had two principal cities—Kadesh, or the Holy City, and a great commercial emporium, which was their capital and the center of their power, called Carchemish. They were finally overthrown by the Assyrians, B. C. 718, and had so completely disappeared that they are scarcely ever referred to by Greek writers. Great interest was felt to discover the site of their commercial capital, Carchemish, and many conjectures have been made, none of which, however, could be verified. A few years ago Mr. Skene, the British Consul at Aleppo, discovered a huge mound of earth covering a large area on the western shore of the lower Euphrates, near a ford of that river on the route still traversed by caravans. This great mound was surrounded by ruined walls and broken towers, while the mound itself was but a mass of earth, fragments of masonry, and *débris*. It had frequently been seen by previous travelers, but they identified it with other lost places. Mr. Skene called the attention of the late George Smith, the eminent archæologist who brought so much to light from the ruins of Nineveh, to this mound, and Mr. Smith found here the long-lost capital of the Hittites. The present British Consul, Mr. Henderson, has been during the last two years engaged in the exploration of the mound, and has already sent important remains with inscriptions to the British Museum.

A few years ago a stone which had formed part of the wall of a house at Hamath had an inscription upon it which excited great curiosity, because it was neither Assyrian nor Egyptian, but something between both languages. It may be remembered that I called attention in one of my former addresses to the discovery of this stone and one or two others containing like characters, which were then called the Hamath inscriptions, with the suggestion that this might probably be the language of the Hittites, which is now proved to be the fact. The inscriptions found by Mr. Henderson in the exploration of Carchemish are not only of the same character, but the same language which Mr. Layard found impressed upon seals discovered by him in the ruins of the record chamber of Sennacherib's palace, and which greatly excited his curiosity, as the writing was unlike any ever noticed before. Another inscription was afterward discovered at Aleppo, by Mr. Davis, a missionary; and it also turns out that the famous figures sculptured above the roads from Ephesus to Phocea, and from Smyrna to Sardis, which are mentioned by Herodotus, and were supposed by him to represent the Egyptian King Rameses II., the Sesostris of the Greeks, had inscriptions in the same character as that recently found in Carchemish, showing that these figures also are Hittite monuments. It is supposed that this language was the source of what is known as the Cypriote syllabary, found in Cyprus, and which was probably the language in use among commercial people throughout Asia Minor until it was superseded by the simpler and more practical Phœnician alphabet. This discovery is exceedingly interesting, as the Hittites belong to the same race of people who perfected, by the invention of the alphabet, that greatest of human inventions, a written language. We have now, in this discovery of Mr Smith, the memorials of a lost people, in neighboring proximity to the Phœnicians, of whom also we know so little—a people who had an important part in the early progress of ancient civilization, with respect to which an eminent Egyptian scholar expresses his conviction that future discoveries in the course of this exploration will afford convincing proofs that this civilization, which was of the highest antiquity, was of an importance which we can only guess at.

A writer in the London *Times* has said, in respect to these discoveries, that they have opened up to us an extinct civilization that existed before Rome or Athens was founded, of which nearly every trace and memorial had been lost until these discoveries were made a few years ago; that they have opened a new and earlier page in the history of mankind—in that of religion, science, and of the arts—by the discovery of the remains of this library, which Abraham may have consulted in what was the land of his nativity.

Fishes on the Pacific Coast.

At a recent meeting of the California Academy of Sciences, Professor Jordan, of the United States Fish Commission, said that the labors of himself and associates have, as yet, been principally confined to the waters of San Diego, San Pedro, and Santa Barbara. Among the specimens of fish examined were the European shark, of which little has been heard on this coast, but it is taken by thousands in Los Angeles waters for the oil. Mr. Jordan here exhibited a specimen of the true sole, the only one yet found on the Pacific coast. The fish sold in our markets as soles are different kinds of flounders. The one shown was picked up in the Chinatown of Los Angeles. Of the flounders, two new species have been found. One was caught just outside the Golden Gate, and is evidently the young of a species that grows to a large size. The only other specimens of the species known were found in Greenland. Another flounder was of the halibut form. Other new forms were found of the sting ray. It was found off San Diego, and is of the European genus. Another ray, caught off Santa Barbara, belongs to the Chinese genus. This is only another evidence that fishes of the same genera are common to both sides of the Pacific, and, as the speaker facetiously remarked, "forming another link between California and China." It is almost as easy, said Mr. Jordan, to find new genera as new species on this coast. Several sharks, about three feet long, were found off Santa Barbara, which have the peculiar faculty of inflating themselves with air when caught, until they are two-thirds as broad as they are long. This has only been known before by specimens brought from Van Diemen's Land. To the eleven species of rock cod, seven more have been added. Most of the new species are of a bright red color. Another new species of surf fish or perch was found in the San Francisco market.

A Wasp's Strategy.

Mr. Seth Green says that one morning, when he was watching a spider's nest, a mud wasp alighted within an inch or two of the nest, on the side opposite the opening Creeping noiselessly around toward the entrance to the nest, the wasp stopped a little short of it, and for a moment remained perfectly quiet. Then reaching out one of his antennæ, he wriggled it before the opening and withdrew it. This overture had the desired effect, for the boss of the nest, as large a spider as one ordinarily sees, came out to see what was wrong and to set it to rights. No sooner had the spider emerged to that point at which he was at the worst disadvantage, than the wasp, with a quick movement, thrust his sting into the body of his foe, killing him easily and almost instantly. The experiment was repeated on the part of the wasp, and when there was no response from the inside he became satisfied, probably, that he held the fort. At all events, he proceeded to enter the nest and slaughter the young spiders, which were afterward lugged off one at a time.

Decision on an Injector Patent.

March 10, 1880, Judge Wheeler, of the United States Circuit Court for the Southern District of New York, rendered a decision in a case in which Nathan & Dreyfus, proprietors of James Gresham's patent (No. 57,057) for "a supplementary jet-lifting apparatus for injectors," sued the New York Elevated Railroad and Wm. L. Chase for an infringement of that patent. The injector which they claimed to be an infringement was that known as the "Little Giant Injector," made and sold by the Rue Manufacturing Company, of Philadelphia. This suit was brought in 1876. The court sustained the validity of the Gresham patent, found that the "Little Giant" injectors complained of were an infringement of that patent, and granted an injunction and referred the subject for an accounting of the damages. Nathan & Dreyfus now give notice that lifting injectors of this pattern are infringements of their patent, and announce that they will settle for such infringements on reasonable terms with all users who respond promptly, and without litigation.

RECENT DECISIONS RELATING TO PATENTS, ETC.

U. S. Circuit Court—Eastern District of Wisconsin.

GOTTFRIED *et al.*, *vs.* THE PHILLIP BEST BREWING COMPANY *et al.*—IMPROVEMENT IN PITCHING BARRELS, PATENTED MAY 3, 1864.

[It is not often that so many interesting questions are involved and decided in a single case as in the following.]

JOINT INVENTION.

1. To overthrow the presumption of joint invention raised by the filing of a joint application upon a joint oath the evidence must be clear and unequivocal.

2. Joint invention is the result of mutual contributions of the parties; and if one suggests an idea in a general way and the other falls in with it, and by his aid develops and gives definite practical embodiment to it, the two may be considered joint inventors.

A LICENSEE FOR A PARTICULAR MACHINE CANNOT SUBSTITUTE THEREFOR A NEW MACHINE.

3. The defendants claimed to be licensees under the patent by reason of a purchase from one of the inventors of a machine used by him; but it appearing that said machine was subsequently torn down and afterward rebuilt of substantially a new construction, it was held that the identity of the original machine was thereby destroyed, and the evidence did not disclose such facts as to show that the patentees had expressly or impliedly given to the defendants license or permission to use such machine.

SIMPLICITY AND ECONOMY OF CONSTRUCTION ARE SUFFICIENT TO SUPPORT A PATENT.

4. The patent law protects simplicity and economy of construction as against prior complex and expensive combinations; and although the general and abstract effect may be analogous, if the two mechanisms produce their respective results by essentially different processes, the one being more simple and capable of being operated with greater economy than the other, it is not anticipated thereby.

REQUISITES OF SUCCESSFUL PRIORITY.

5. A prior patent or publication, to anticipate a patent, must appear in the description to embody substantially the same organized mechanism, operating substantially in the same manner as that described in the patent claimed to have been anticipated.

THE NEW ARRANGEMENT OF OLD DEVICES MAY BE PATENTED.

6. Old instruments placed in new and different organizations, producing in such situation different results, or the same results by a new and different mode of operation, do no prevent such newly-organized mechanism from being patentable.

TO OVERTHROW A PATENT THE ALLEGED PRIOR DEVICE MUST BE PERFECTED AND PRACTICAL.

7 To justify the court in overthrowing a patent granted for what appears to be a new and useful invention or improvement, on the ground that the device has been anticipated by another and earlier invention, the court should be well satisfied by clear and credible testimony that the alleged earlier invention actually existed; that it was a perfected device capable of practical use; that it was embodied in distinct form and carried into operation as a complete thing, and was not of such character as to entitle it only to be regarded as an unperfected or abandoned experiment.

8. A rude machine constructed for the purpose of experiment, and subsequently broken up, deserted, and abandoned, cannot be regarded as such a perfected invention as will defeat a patent

NEW COMBINATIONS OF OLD PARTS ARE PATENTABLE.

9. Although the various elements or parts of the patented mechanism, when separately considered, may be regarded as old, they are to be viewed in the light in which they have been combined in connection with the new and useful results which the combination accomplishes.

THE CLAIMS ARE TO BE EXPLAINED BY THE SPECIFICATIONS

10 A claim to "the application of heated air under blast to the interior of casks by means substantially as described and for the purposes set forth," embraces the particular means and mode of operation described in the specification.

11. Claims containing words referring back to the specification must be construed in the light of the explanations contained in the specification.

12. It is sufficient for the purpose of distinguishing old parts from new in the specification and claims of a patent to describe each and all of the parts, and claim the mechanism as a whole, so constructed and operated as to produce the result set forth.

MECHANICAL INVENTIONS.

An improvement in axle boxes which will prevent the oil or grease from flowing out of the box, and will prevent sand from entering it, has been patented by Mr. Irving F. Burdick, of North Stonington, Conn.

An improved hay press has recently been patented by Mr. Beverly Tompkins, of St. Albans, West Virginia. This invention is an improvement on the hay press, for which application for patent was allowed to the same inventor June 13, 1879. It consists of a novel arrangement of levers for operating the traverser and follower of the press.

A harrow that can be readily adjusted for light or heavy work, be made to accommodate itself to uneven ground, and be moved anywhere without being taken to pieces, has been patented by Mr. William W. Cook, of Kansas Centre, Kan.

Diamond Making.

The London *Photographic News* sums up briefly the result of diamond making as follows: A hydrocarbon gas—such as marsh gas, for instance, which is composed of hydrogen and carbon—is put into a stout iron tube of considerable thickness. A nitrogen compound—presumably cyanogen—is also introduced, with a view to the nitrogen combining with the hydrogen, and leaving the carbon free, for a diamond, as our readers are aware, consists of pure crystallized carbon. The gas in the iron tube is subjected to enormous pressure to liquefy it, the tube being heated to aid in this work. The liquefaction of oxygen by Pictet, of Geneva, was effected by pressure in this way. The pure carbon passes under pressure from a gaseous into a liquid form, and finally crystallizes, in which condition it is found upon the iron tube being opened. The diamonds are, however, of the most minute character, and Mr. Hannay, of Glasgow, who has thus succeeded in making them, frankly owns that the game is not worth the candle.

When Trout May be Caught.

The *Sea World*, a sprightly little paper devoted to the fish interests, published at New Haven, Conn., gives the following information regarding the laws of different States in respect to trout fishing:

California, April 1 to November 1.
Connecticut, April 1 to July 1.
Iowa, February 1 to November 1.
Maine, May 1 to October 1.
Massachusetts, April 1 to October 1.
Michigan, May 1 to September 1.
Minnesota, April 1 to October 1.
New Hampshire, May 1 to October 1.
New Jersey, March 1 to October 1.
New York, April 1 to September 1.
North Carolina, January 1 to October 15.
Pennsylvania, April 1 to August 1.
Province of Ontario, Canada, May 1 to September 15.
Province of Quebec, Canada, February 1 to October 1.
Rhode Island, March 1 to August 15.
Vermont, May 1 to September 1.
Virginia, April 1 to September 15.
Wisconsin, April 15 to September 15.

Total Solar Eclipses.

According to Professor Davidson, of San Francisco, the most important total solar eclipses during the present century will be as follows:

Date.		Most favorable locality for observation.	Duration of Totality
Year.	Month.		
1882	May 17	Arabia	3 min. [illegible] sec.
1883	May 6	Marquesas Islands	5 min. 15 sec.
1885	Sept. 9.	New Zealand	2 min. [illegible] sec.
1886	Aug 29	West Africa	6 min. 21 sec.
1887	Aug 19	Russia	[illegible] min. 4[illegible] sec.
1889	Dec. 22	Angola, West Africa	3 min. 34 sec.
1893	April 16	Brazil	4 min. 44 sec.

The next total solar eclipse visible near the United States will be that of May 28, 1900, at 3 o'clock in the afternoon; wherein the central line of totality passes through Mexico, the Azores, and Egypt

Water Cresses.

At a recent meeting of the Royal Horticultural Society of England, Mr. Shirley Hibberd exhibited a lot of home-grown water cresses, which created considerable interest among the members. The display consisted of a series of pans, fifteen inches in diameter, each filled with a luxurious growth of tender cresses. The exhibitor claims that the pan culture of water cresses may be profitably pursued with the aid of a frame or cool plant house during the severest winter weather. The cresses shown were produced in the course of six weeks, and had been daily gathered for the table, thus showing how rapidly and prolific they grow. According to the testimony of Mr. Hibberd any one may supply his table with this wholesome and delicious salad any time of year without much trouble or expense.

Correspondence.

The La Plata Mining and Smelting Company.

To the Editor of the Scientific American:

One of the most complete ore sampling and smelting companies in the carbonate region is the La Plata Mining and Smelting Company. Like most of the enterprises of this new and wonderful region, it developed into its present large proportions, from a small and unimportant beginning. About the middle of June, 1879, the present corporation was established with a capital stock of $2,000,000, in 200,000 shares, par value $10 each, although prior to the above date the firm of Berdell, Witherel & Co. had carried on the business of smelting ores with marked success. In order, however, to meet the increasing demands of a company where new discoveries of large mineral deposits followed so rapidly after one another, the La Plata company was organized, and with a cash capital of $100,000 business commenced on a scale before unthought of. The working capacity of the mills was largely increased by a judicious expenditure of nearly $50,000, and under the able management of C. B. Rustin, Nathaniel Witherel, and Theodore Berdell, seven dividends, amounting to $115,000, have been paid to stockholders.

The process of sampling and smelting ores in vogue at this establishment is thoroughly approved and entirely satisfactory in its workings and results. The different ores coming from the various mines are first deposited in bins holding about 30 tons respectively. Each mine has its especial bin, and the ores are kept entirely distinct and separate. For sampling purposes about one-tenth of a particular ore is taken, and is cut down to a sackful containing from 60 to 100 lb. This is run through a Blake crusher, which breaks up the larger pieces, and renders the whole sufficiently fine for the furnaces. One tenth of the residuum is then subjected to the Cornish rollers, which crushes it very much finer. The Aldis crusher then pulverizes it, and it is afterwards manipulated on the bucking board until it is of the consistency of a fine powder, capable of going through an "80 sieve." One-fourth of this powder is sent to the assay room, where the "assay ton" is taken, reckoned in milligrammes, and a valuation made of the entire amount of ore; one-fourth of the powder is given to the miner; the other two-fourths are bottled, labeled, and sealed for reference. Should the assay of the miner and the smelter disagree, the valuation is either determined by the other sample, or, to use a Yankee expression, they "split the difference." For purposes of smelting, the ores are taken from their bins and deposited in large "mixture piles" containing 300 tons each. These mixtures of ores are taken to the scales and weighed. It is determined in the laboratory what quantity of lime and iron shall be added for a flux to the various grades of ore. Having determined the requisite amount of fluxes necessary for a single blast, the compound mass is taken to the furnace room, where four large blast furnaces, with an aggregate daily capacity of 110 tons, are kept in constant blast. At the end of 24 hours the ore is run off in the shape of bullion pigs weighing 95 lb. The slag is run out from a different aperture, and is thrown on the "dump" as useless material. These pigs of bullion are carefully assayed to determine their exact value, and are then shipped to the Newark, N. J., refining works, where the silver is separated from the lead and the lead then refined. The product of the La Plata Mining and Smelting Company, from its organization, June 14, 1879, up to March 1, 1880, has been 1,155,661 oz. silver, and 7,083,769 lb. of lead, for which 36,917,396 lb. of ore were required. The aggregate yearly production of silver alone will considerably exceed a million and a half of dollars. The most imposing object that strikes upon the vision of the stranger coming into Leadville for the first time is the works of the La Plata Company. They cover 25 acres of ground, with a frontage of 550 feet. About the buildings of the works themselves, which are large and substantial, there clusters a small village of dwelling houses for the accommodation of the 100 employes of the company. The company owns and operates mines located in California Gulch, which yield an immense quantity of low grade mineral, so necessary for successful smelting. This together with its extensive patronage by such mines as the Chrysolite, Iron, Little Chief, and Climax mines, keeps the furnaces in constant operation.

To indicate the high position this company occupies in the business community it will be sufficient to name the officers of the corporation, as follows: C. B. Rustin, president; N. Witherel and Harry Allen, vice presidents; Theodore Berdell, treasurer and agent in Colorado; and Fredrick Sheppard, secretary. Mr. C. B. Rustin, aided by his energetic and experienced superintendent, Mr. M. E. Smith, directs and oversees with vigilance and ability every department of the complicated business. W.

Leadville, March 25, 1880.

The Voice of the White Perch.

A correspondent writing from Parkersburg, West Virginia, says, with reference to the note on voice in fishes, in the SCIENTIFIC AMERICAN, February 14, 1880, that the white perch of the Ohio river will often follow a boat for a considerable distance, all the time making a peculiar humming noise like that of a telegraph wire in the wind. He has heard the fish make the same sound when imprisoned in a fish box to keep it alive.

Glucose—Grape Sugar—Corn Sirup.

The wonderful impetus that has recently been given to the manufacture of glucose and grape sugar from corn, has awakened an interest in the early history of the industry and its introduction into this country. Mr. Lyman Bradley, one of the original inventors of the process of producing those articles from corn, writes to a Buffalo paper in reference to it as follows:

"Grape sugar was long before made from potatoes in Europe, and came here at a cost of from 8 to 12 cents a pound, in gold, when gold was at a premium of 40 per cent. But sugar from corn was not then known. In the year 1863, F. W. Gessling and Lyman Bradley, in the city of Buffalo, improvised a small factory for experimenting, to see if grape sugar, glucose, and sirup could be made from corn. Although sneered at and ridiculed by their friends as insane, they, by their persistence, succeeded, and in 1864 they obtained a patent, which may be seen on the records at Washington. In July, 1864, a committee of sugar manufacturers and chemists from New York visited Buffalo as experts, to report as to the value of the invention. They remained several days, testing the process. They returned, and others from New York took their places for the same purpose. The patentees employed a well known citizen of Buffalo to negotiate a sale of the patent, and on the 10th of November, 1864, a sale was made for $600,000, a stock company formed with a capital of $1,000,000, and stock issued, some of which may be seen in Buffalo bearing that date."

From the supposed folly of Gessling & Bradley has grown up a business in which nearly $30,000,000 are invested. Grape sugar has been made from potatoes and imported here to be used in making wine, costing near 12 cents per pound, it being better than cane sugar for that purpose, it having no taste but sweet if properly made. No grape sugar, no glucose, no sirup, was ever made on this continent or elsewhere from corn until after the invention so made by Gessling & Bradley, and if any credit is due to any one for inventing a process which is proving to be so valuable, the meed of praise belongs to them. For now, instead of importing an inferior article of grape sugar, made from potatoes, at a cost of 8 to 12 cents a pound, large quantities of grape sugar made from corn are exported at 3 cents a pound.—*The Western Manufacturer.*

The Compression of Gaseous Mixtures.

In a recent paper on this subject to the Paris Academy of Science, M. Cailletet begins with the remark, that when a mixture of air and carbonic acid was inclosed in the apparatus which had served him for liquefaction of gases, he found, as Andrews and several other savants had already observed, that the liquefaction of carbonic acid was retarded, often very greatly. It is even possible to compress at zero, beyond 400 atmospheres, a mixture of 1 volume of air and 1 volume of carbonic acid, without getting a change of aspect in the tube.

On compressing in the apparatus, he proceeds, 5 volumes carbonic acid and 1 volume air, the carbonic acid is easily liquefied. If the pressure be then carried to 150 or 200 atmospheres, the meniscus of liquefied acid, which, up to that point, was concave and perfectly distinct, becomes plane, loses its distinctness, then is progressively effaced; at length the liquid entirely disappears. The tube then seems filled with a homogeneous matter, which thenceforward resists all pressure as a liquid would.

If, now, the pressure be slowly diminished, one perceives that at a pressure constant for determinate temperatures the liquid suddenly reappears; a thick mist is produced, developing and vanishing in an instant, and marking the level of the liquid which reappears. The following numbers indicate the progress of the phenomenon.

Operating with a mixture formed approximately of 5 volumes carbonic acid and 1 volume air, the liquid carbonic acid reappears at:

Atmospheres.		Degrees.
132	at the temperature of	+ 5·5
124	"	10
120	"	13
113	"	18
110	"	19

The carbonic acid compressed above 330 atm. no longer liquefies at 21

This phenomenon of disappearance of the liquid cannot be explained by the heat disengaged by compression; for, in this experiment the tube is immersed in water, which keeps the temperature constant, and the compression is effected slowly enough for the cooling to be always complete.

The whole phenomenon, indeed, is as if, at a certain degree of compression, the carbonic acid is diffused in the gas above, producing a homogeneous matter, without sensible change of volume; and nothing seems to hinder us from supposing that the gas and the liquid are dissolved in one another. I have tried to verify this hypothesis by coloring the liquefied carbonic acid. Of all the substances tried, iodine alone was capable of dissolving in the acid; but, unfortunately, in this experiment the mercury is rapidly attacked, and the phenomenon is immediately masked by the iodide of mercury, which is deposited on the wall of the tube.

One might, however, suppose that the disappearance of the liquid is only apparent; that the index of refraction of compressed air, increasing more quickly than that of the liquid carbonic acid, there comes a moment when the two indices becoming equal, the surface of separation of the liquid and the gas ceased to be visible. But if, then, we augment several hundred atmospheres the pressure of the system, the surface of separation of the gas and the liquid should become visible again, the index of refraction of the gas continuing to increase, by hypothesis, more rapidly than the index of the liquid. But experiment, pushed to 450 atmospheres, gave only negative results.

We may, then, suppose that at high pressures a gas and a liquid may be dissolved in one another, so as to form a homogeneous whole.

An Englishman's Views on American Manufactures.

In a lecture recently delivered in Sheffield, England, Mr. W. K. Marples, of that town, related his experience and observation in his travels through the United States.

"I found," says the lecturer, "in visiting various American factories, machinery much more generally used than it is with us—in fact, I sometimes saw machinery employed for a process which might have been done more cheaply by hand labor; but we must remember that until recently skilled workmen were not numerous in the States, and so manufacturers were driven to the use of machinery. The Americans are much more advanced in manufactures of all kinds than many of us are aware. Cabinet furniture, glass and china, cutlery tools, guns and pistols, agricultural implements, carpets, linen, in fact, soft and hard goods of every description are made, and in most instances made well, in the United States. Their resources are wonderful; nature has given them coal, iron, waterpower, etc., with the finest navigable rivers in the world, and then their chiefly English origin has given them pluck, endurance, and perseverance under difficulties, and these qualities, coupled with the immigration of many of our best artisans, have in the comparatively short space of 100 years worked marvels for them. The New England States are one vast hive of manufacturing industry, and it is here that the brains of inventors are stimulated to their utmost powers in developing labor-saving articles, and the machinery to make them.

"I think the introduction of the many American ideas and inventions into England that has been attempted during the past few years will tend to develop new ideas among our workpeople, and assist us in holding our position as the great manufacturing nation of the world. I have little fear that English hardware manufacturers will succeed in holding their own in all markets where the duties are not prohibitory, as in the United States. There is little doubt that much of the boasted superiority of American manufactures in the matter of price was a mere myth, and I am fully convinced that until a few months ago, when the hardware trade in America was so depressed, the manufacturers there exported goods to England at a positive loss. In some cases this has been admitted, and the enormous advances, amounting in some goods (notably in locks) to over 100 per cent, bear me out in this opinion. Many goods, that up to a short time ago were imported from America, are now manufactured in England, and the Americans would seem to be doing their best to destroy the trade which until recently they were apparently so anxious to build up. English manufacturers have been fully alive to the situation, and will not readily allow American manufacturers to recover the ground they are now losing."

The Railways of London.

A London paper states that the rails used by the companies within a radius of 6 miles of Charing Cross would form a single line from London to John O'Groat's house, a distance of 750 miles. This estimate does not include the rails in bays and sidings, but it includes all double, treble, or quadruple tracks. Leaving all duplicate lines aside, the incredible number of 260 miles of railway is in daily operation in the metropolitan district. From Hendon and the Alexandra Palace on the north to Penge and Streatham on the south, from Forest Gate and Woolwich on the east to Acton and Willesden in the west, thirteen different companies hold sway, not including the East London, whose line is worked by another company. There are also six short lines, varying from 4¾ miles to 1 mile in length, owned and worked by the companies jointly. The Brighton Company owns the greatest mileage in the metropolis—37 miles. It is closely run by the Great Eastern with 32. Then comes the London and Southwestern with 27; the London, Chatham and Dover and Northwestern follow with 24 each. So far as using the lines are concerned, the London and Northwestern run over more than one-fourth of the whole metropolitan system. The trains of this great company use the lines of five other companies, practically adding 44 miles to their own system. The Great Northern has running powers over the lines of six companies, embracing 36 miles. The mixed nature of the metropolitan system is apparent in the fact that over the London, Chatham and Dover Railway five companies run their trains. The Metropolitan Company's lines are open to four companies. The Southeastern alone uses no other lines, though it has running powers over the East London. If there be added to this astonishing system of locomotion the 70 miles of tramways now open, the omnibuses which ceaselessly traverse the metropolis from one end to the other, the thousands of cabs, the passenger steamers which ply on the river—the magnitude of the means daily employed by the people of London in getting from one part of the "New Babylon" to another will strike the observant mind. With all this vast traffic the injuries to life and limb, save in the cases of street accidents, are comparatively few. With trains flying above ground and underground, over complicated points and through crowded junctions, collisions seldom occur and seldom result in loss of life.

THE LITERARY REVOLUTION.—HISTORY.

On another page will be found advertised Macaulay's England, in three volumes, Knight's England, in four double volumes, Gibbon's Rome, in five volumes, and other standard histories, at prices which place them within easy reach of thousands who could never before reconcile their literary longings with their scanty belongings. The prices are now the marvel. At first readers doubt if they are real; then if the books are well made: for no previous experience shows that books can be at once good and cheap. When actual inspection demonstrates that they are well printed from good type, on fair white paper, and are bound neatly and durably, then the marvel is that the thing can be done. For the publishers deny that they are giving their wares away. They have simply adopted a system by which the eager crowd that wants their books get with them whatever advantage may accrue from large editions, cash sales, and the abrogation of the long series of intermediate profits that usually lie between the maker and the buyer.

Type setting by steam lends its aid. The compositor sits before his lettered key-board like an organist at his desk; the types, responsive to the call of his deft fingers, step out into the ever-growing file, whence a second workman takes the ranks that march in solid column down the printed page. Brains guide this machine, but the distributer is entirely automatic, assorting the letters swiftly with the utmost precision.

Although history is prominent in this advertisement, the issues of the American Book Exchange include many other works of standard merit. Descriptive catalogues of books now ready, and of important additions to be made at no distant day, will be cheerfully sent to any address.—*Adv.*

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

NEW BOOKS AND PUBLICATIONS.

Deutsch Amerikanische Apotheker-Zeitung. A semi-monthly gazette devoted to the interests of Apothecaries, Physicians, Chemists and Druggists. New York: Pharmaceutical Publishing Company, 5 Gold street. Price $2.50 a year.

The first issue of this new periodical is well printed on Roman type, and contains a number of articles of interest and value to German reading apothecaries and druggists, a price list of drugs and chemicals, and a report of the drug market. It has sixteen pages about three fourths the size of the Scientific American, and bears evidence of ability and vitality enough to give it an honorable rank among trade journals.

Responsibility Restricted by Insane Delusion. By T. L. Wright, M.D. Paper, pp. 16. Reprint from Cincinnati *Medical News*.

Dr. Wright's conclusions are that the partially insane should be held responsible for crime; that the degree of responsibility attaching to the acts of the monomaniac is less than that which belongs to sound minds; and that capital punishment should never be visited upon one infected with any taint of lunacy.

The American House Builder. By R. G. Hatfield. Edited by O. P. Hatfield. New York: John Wiley & Sons. 8vo, cl., pp. 685. Price $5.

This is the eighth edition of the well known treatise on the art of building by the late Mr. Hatfield. During the last year of his life the author thoroughly revised his work and rewrote a large part of it, making many additions. The new volume is published in the same style as the author's work on "Transverse Strains."

Key to Ghostism. Science and Art Unlock its Mysteries. By Rev. Thomas Mitchell. New York: S. R. Wells & Co.

A curious book which, while it exposes in a way the absurdities of "ghostism," still seems to leave the author in a mental condition scarcely more creditable than that of the victims of the delusion he combats. The science of the work is of that amazing kind which has not even a ghost of the spirit of true science about it, let alone any material basis.

Ueber die Verwerthung der Linien gleicher Höhe für Bergbau, Forst-, Land-, und Volkswirthschaft und deren Wichtigkeit für die Fruchtbarkeit und den Wasserreichthum sowie den Verkehrlines Landes. Von K. Ludolff. Prague: H. Dominicus. Pp. 82. 1878.

Treats of the use of lines of equal height in mining, forest culture, national economy, etc., meaning by the term, lines following the contour of the earth's surface, but always preserving the same level. For example, to maintain the level of a mill race or aqueduct without viaducts or tunnels, the channel must be carried around all the curvatures of hill and valley, its course forming a line of equal height. The author points out the applications and usefulness of such lines in the several varieties of engineering work.

Archimedes' Levers: The Fulcrum Found by Will Powers. Philadelphia: G. W. Townsend.

A packet of slips of note paper, along the margins of which are printed these words: 1, The Cause or Source? 2. Its Essentials? 3. Associated with? 4. Its Incidents? 5. It Illustrates? 6. Its Effects? 7. Conclusions? These seven "levers" the student is expected to use in the analysis of subjects suggested or taught in newspaper articles, books, etc. Habits of critical note-taking are well worth cultivating; and these slips might be handy for such work. The suspicion, however, that the author has experimented with the "levers" and thereby acquired the style of writing and thinking shown by him on the cover of the packet, will be likely to prevent any large use of them.

The Field Engineer. By William Findlay Shunk, C. E. New York: D. Van Nostrand.

A handy (pocket) book of practice in the survey, location, and track work of railroads, prepared with special reference to the wants of young engineers who have not had the advantage of a technical education.

A Practical Treatise on Nervous Exhaustion (Neurasthenia), its Symptoms, Nature, Sequences, and Treatment. By George M. Beard, M.D. New York: William Wood & Co.

Dr. Beard writes as a specialist for the practical instruction of general practitioners of medicine, his aim being, in his own words: To describe with thoroughness, if not exhaustively, the symptoms of neurasthenia—those hitherto assigned to other affections, or regarded as special and distinct diseases, to show their relations and interdependence; to distinguish them from the oftentimes closely resembling symptoms of organic disease on the one hand, and the symptoms of hysteria and hypochondria on the other; to unify and harmonize the complex developments and manifestations of this malady; to indicate its pathology and rationale; and to trace out in detail its prognosis, sequences, treatment, and hygiene. "The hygiene of nervous diseases has three gospels—rest, work, and change of work."

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the Scientific American Supplement referred to in these columns may be had at this office. Price 10 cents each.

(1) G. W. D. asks: What is the rule for determining the size of steam ports, the area of piston being known? A. Generally from one-ninth to one-eighteenth the area of the piston, depending upon the pressure of steam and velocity of the piston.

(2) W. T. B. asks: Which has the most brains, the best chemist in the world or the best carpenter? A. We do not know of any carpenters who have ranked so high as the "best chemists," on the score of brain, capacity, power, and learning. Certainly chemistry calls for a higher and wider range of exact knowledge and greater mental power and acuteness than carpentry does; and for quite as much manual skill.

(3) L. H. McF. asks: 1. Ought pure alcohol be used for preserving natural history specimens? A. Spirit of wine will answer as well as strong alcohol. 2. Will methylic or wood alcohol answer the purpose? A. Yes; in some cases alcohol is preferable.

(4) O. R. R. asks: 1. Is there any way known of keeping milk without retaining it somewhat in bulk? A. Milk has been preserved for some time by the addition to it of salicylic acid in the proportion of ten or twelve grains to the quart; also by the use of iodate of calcium. Neither of these, however, are desirable in milk. 2. If a method could be discovered by which this could be done would it be of any great value? A. Very probably.

(5) R. S. M. asks: 1. If a pipe be laid five miles long over hills and down valleys, the fall being ten feet to the mile, or 50 feet total, and the pipe be kept full of water at the upper end, would the pipe be full at the lower end? I say not; am I right? A. If we understand your question, you are correct. 2. Would not the water all pass through a pipe one half the size the last, say, 100 feet? If not, what proportion? A. The size of pipe at the lower end, to discharge all the water supplied from the upper end, will depend upon the total length of the pipe, and the number and character of the bends. 3. Would not the water flow more freely on a gradual grade than moving up and down with the hills? A. Yes.

(6) E. H. W. writes: In your issue of the Scientific American of March 20, under the head of "Notes and Queries," No. 22, S. G. asks about making a small engine cylinder of Babbitt metal. You directed him to use a piece of brass tubing instead, which corresponds with my idea of a small cylinder. I just successfully completed an engine a few weeks ago, cylinder 13-16 inches diameter by 2¼ inches stroke, with brass tube for bore of cylinder, and with Babbitt metal cast around it in the form necessary. It is a slide valve engine. Have not applied it to any machinery yet, but feel confident it will run several sewing machines at once.

(7) S. B. H. asks: Can the chemicals and impurities of a negative bath be identified by the help of a microscope, either in the solution or after evaporation? A. The microscope would be of little service in this connection.

(8) W. E. A. writes: I have been trying to make an imitation amber, for manufacturing purposes, but can't get it just right. Can you give me a formula or some hints in regard to it? A. A fictitious amber is prepared by melting pure bleached shellac, and keeping it over the fire until it runs clear, with care to prevent burning. It may be poured into moulds of the size of pieces required. The operation requires considerable management. The darkest and hardest pieces of gum copal are also substituted for amber. The copal may be fused with the shellac.

(9) I. P. asks: 1. How many pounds of cast iron can I melt in a crucible in a brass furnace? A. 10 or 12 lb. can be handled very well. 2. How many melts can I make in a crucible before danger of cracking? A. If carefully handled, two or three. 3. What must I use for a flux for cast iron? A. A little borax, or charcoal and carbonate of soda. These are not essential. 4. What can I add to scrap to make a soft casting? A. Powdered iron ore—iron rust.

(10) G. P. P. asks (1) where to find directions for making a small electric motor. A. In article on "An Electrical Cabinet" in Supplement No. 191. 2. How can I make an Edison loud speaking telephone? A. See p. 198, vol. 41, Scientific American. 3. What is the chemical reaction when the solution for chemical telegraph is decomposed by electricity, the positive electrode being of iron? (The solution is the same as described on page 234 (24), Vol. 41, Scientific American. A. Ferric oxide is formed, which combines with the potassium ferrocyanide forming Prussian blue (Fe_7Cy_{18}).

(11) H. A. R. asks how to make the best stove polish. A. Use pure graphite (plumbago) reduced to a fine powder and made into cakes by strong pressure.

Minerals, etc.—Specimens have been received from the following correspondents, and examined, with the results stated:

S. P.—The mineral is a micaceous hematite; it is a valuable ore of iron readily mined and in large quantities.—J. D. C.—No. 1 is a good sample of argentiferous galena. The property is probably valuable. No. 2 is carbonate of lime.—M. F. R.—The sample is fool's gold and contains none of the precious metals.—J. . . . . The substance is mica and if in larger plates would find a ready market.—T. X. O.—No. 1 is a lead carbonate carrying silver. An assay would be advisable. No. 2 is decomposed granite.—L. S.—The ore is evidently a selected specimen. It is worth about $200 per ton.—R. C. G.—They are not diamonds but quartz pebbles. No. 1 is worn by water. No. 2 is not a mineral but a fragment of shell.—H. H. B.—The substance is a green marl and is much used as a fertilizer.—J. B. S.—It is not malachite but hardened green paint.—R. & Co.—Sample in green box. No. 1 is iron pyrites in slate. No. 2 is chrome iron ore.—M. E. C.—Copper and iron sulphurets probably carrying a little silver.—J. H. T.—Quartz, iron sulphide, fluorspar. An assay would be necessary to ascertain the presence or absence of the precious metals.

COMMUNICATIONS RECEIVED.

On Cotton Pickers. By I. J. M.
On Spontaneous Combustion. By J. T. R.
On Perpetual Motion. By H. S. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 16, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, of any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Animal trap, A. McClain 225,634
Animal trap, J. H., W., & T. D. Morris 225,634
Anvil and vise, combined, W. R. Canedy 225,368
Apple grinders, pressure plate for, Boomer & Boschert 225,458
Auger, earth, A. J. Collins 225,508
Auger, hollow, E. C. Stearns 225,406
Bale tie, cotton, S. H. Gilman 225,517
Bedstead, invalid, P. F. Adams 225,465
Boilers to prevent incrustation, device for feeding fluid into, W. Linehan 225,622
Boot, R. Church 225,369
Bottle and glass stopper, glass, R. P. Smith 225,404
Bottle stopper, C. G. Hutchinson 225,436
Bottling machine, C. G. Hutchinson 225,415
Bracelet, J. Sweet 225,661
Brick, pottery, etc., kiln for burning, N. B. & E. M. Hoafer 225,368
Bridges, guard gate for swing, Bockr & Joyce 225,665
Bung, beer, A. Fuldner 225,515
Burglar alarm, S. D. Hoopt 225,666
Burglar alarm, percussion, W. H. Reiff 225,534
Burglar alarm, portable, W. H. Reiff 225,641
Buttons, etc., from plastic materials, manufacture of, W. L. Palmer 225,639
Buttons, etc., manufacture of, Bliss & Badger 225,356
Car brake, railway, J. R. Jones 225,611
Car coupling, O. H. Drinkwater 225,376
Car coupling, J. S. Fisher 225,383
Car coupling, J. Haffner 225,590
Car coupling, J. N. Winn 225,675
Car, stock, T. Clarke 225,507
Car, stock, G. F. Patterson 225,646
Car wheel chill, J. N. Barr 225,349
Carriage bolts, die for making, I. Newton 225,502
Carriage dash frame, B. J. Warden 225,669
Carriage top, landau, H. Lines (r) 9,117
Cartridge, M. Coloney 225,465, 225,466
Cartridge primer, J. H. Gill 225,381
Casting rolls, E. L. Lamb 225,470
Catapult, O. H. Curtis 225,540
Centrifugal machine, S. S. Hepworth 225,600
Centrifugal machine, T. H. Muller 225,631
Chandelier, extension, A. H. Jones 225,612
Child's chair, W. F. Barber 225,348
Churn, L. W. Leake 225,620
Churn dasher, W. D. Noell 225,635
Churn motor, J. P. Rogers 225,644
Cloth rolling machine, A. Brown 225,357
Cork handles, covering for steam, J. Morrison 225,491
Comb frame tongs, A. Hansen 225,349
Commode, P. Shankle 225,649
Cooker and drier, steam feed, T. K. Daniels 225,311
Cooker, steam, W. G. Flanders 225,384
Corset clasp, O. C. Haskell 225,590
Corset parts, machine for folding, A. B. Curtis 225,514
Crate, G. E. Bender 225,551
Creamer, S. S. Weldon 225,673
Cultivator, corn, G. E. Johnson 225,608
Curtain roller, Fisher & Gamble 225,583
Dam or sluice weir, clough, A. Pasquesse 225,500
Dental jaw brace, G. H. Hurd 225,385
Disintegrating mill, L. J. Bennett 225,362
Distilling oil, apparatus for, P. Nicolai 225,566
Ditcher and scraper, combined, G. Palmer 225,687
Ditching machine, C. B. Edwards 225,379
Ditching machine, W. Stacy 225,662
Drawer pull, G. L. Donovan 225,576
Earthenware saucepan, M. Schott et al. 225,482
Egg holder, J. McGinnety 225,630
Eggs, composition for preserving, A. Good 225,318
Elevator, J. A. Graham 225,673
Elevator and carrier, combined, A. A. Monson 225,630
Elevator and fountain, A. A. Sanford 225,446
End board fastening, C. F. & E. E. Whipple 225,544
Engraving printing surfaces, M. Bradley 225,453
Envelope, J. D. Terry 225,560
Fare box, W. H. Hornum 225,605
Feed mill, L. J. Caldwell 225,362
Feed water heater and steam generator, C. D. Smith 225,347
Fence builder, wire, W. A. Newton (r) 9,120
File, bill and letter, G. V. Nauerth 225,633
Firearm, magazine, Tinsing & Kennedy 225,664
Flour, etc., apparatus for bolting, Shuttleworth & Morse 225,508
Fruit gatherer, J. N. Jarman 225,610
Furnace grate, W. Gillespie 225,390
Gate, M. C. Doolittle 225,513
Glass, etc., machine for grinding, Lake & Weller 225,418
Governor, W. R. Crane 225,373
Grain cargoes, device for preventing the shifting of, W. E. Ferguson 225,391
Grain drill teeth, detachable point and fastening for, W. H. Wilson 225,474
Grain drill tooth, mechanism for adjusting, W. Q. Prewitt 225,447
Grain rick frame, C. Geiger 225,589
Grate bar, E. Haycox 225,393
Griddle, cake, J. W. Snyder 225,656
Grinding wheels, composition for, C. H. Stevens 225,659
Gun, machine, M. Coloney 225,462, 225,466
Harness maker's stitching horse, C. A. Holland 225,604
Harrow and clod crusher, F. Nishwitz 225,634
Hog and cattle vat, E. Ellis 225,514
Holdback, vehicle, G. W. Hinkle 225,602
Horse quarter boot, E. Barnard 225,347
Horse rake, H. C. Herchelrode 225,603
Hub, vehicle wheel, G. Tesar 225,408
Hydraulic engine, J. H. Kone 225,414
Ice cream freezer, Patterson & Hayes 225,647
Ice cream freezer, Winn & Winship 225,676
Ice pick, C. S. Watson 225,670
Ironing table, C. F. W. Seidel 225,648
Jetty, portable sectional, J. Grant 225,392
Key ring, B. H. Melendy 225,628
Lamp, O. Sweeney 225,662
Lamp body, J. Kintz 225,615
Lamp burner, K. H. K. Hoyby 225,336
Lamp, electric, J. H. Guest 225,394
Latch, gate, S. H. Kiser 225,361
Locked switch, J. W. Reinhart 225,641
Loom shuttle, N. J. Willis 225,673
Loom shuttle motion, I. G. Chandler 225,366
Looms, pile wire mechanism for, G. Dixon 225,469
Marble, ornamentation of furniture, J. Berhay 225,505
Marble veneering, T. C. Lamb 225,614
Measuring device, tailor's, H. H. Woolson 225,679
Meat packing device, E. Detwiler 225,462
Middlings purifier, Case & Stein 225,364
Mining machine, coal, D. W. Siprell 225,404
Mower, H. A. Howe 225,607
Mowing and reaping machine, O. Taylor 225,663
Music leaf turner, F. L. Becker 225,350
Nailing machine, A. Knowlton 225,627
Nailing machine, hand, S. B. Mower 225,493
Ordnance, breech-loading, M. Coloney 225,461
Ore crusher, T. H. Timby 225,665
Paddle for boat wheels, J. L. Cheston 225,367
Paddlewheel, J. Sherry 225,466
Paper bag machine, W. C. Cross 225,370
Paper, blank music, H. L. Hastings 225,466
Paper damping machine, W. Scott 225,401
Paper folding machine, Chambers & Mendham 225,506
Paper machine jacket stretcher, J. Jamison 225,409
Peanut roaster, W. H. Burk 225,563
Peanut stripper, J. T. Jones 225,613
Peg rasping machinery, W. B. Arnold 225,304
Permutation lock, C. J. Reno 225,400
Photographic images, producing, D. N. Carvalho 225,436
Photographic pictures, producing, W. Kurtz 225,479
Pipe crimping machine, F. H. Parkham 225,636
Piston, steam engine, E. M. Birdsall 225,356
Pitman connection, W. F. Rundell 225,645
Planter corn, P. S. Lutz 225,335
Planter, corn, B. T. Stowell 225,409
Plastic compound, A. T. Woodward 225,479
Pliers, parallel, E. N. Parker 225,645
Plow, sulky, F. J. Smith 225,508
Plow, sulky, G. H. Warren 225,604
Post and pile driver, W. A. Newton (r) 9,119
Printing machine, chromatic, G. M. Wright 225,301
Printing press sheet delivering apparatus, S. D. Tucker 225,666
Projectile, H. H. Sibley 225,650
Pump, J. A. Pease 225,490
Pump valve, steam, M. F. De Souza 225,373
Railway switch lever, S. B. Nickum 225,494
Refrigerator, Hale & Ramsey 225,566
Refrigerator, Munsley & Koch 225,639
Registering apparatus, Bennor & Pond (r) 9,118
River banks, device for protecting, Hedges & Needham 225,522
Ruffled fabrics, machine for pressing or creasing, W. Walker 225,667
Safe for provisions, etc., D. N. Smith 225,653
Sash fastener, J. W. Todd 225,541
Sash lock and lift, E. J. Brooks 225,356
Sash, window, D. W. Clark 225,570
Scales, pendulum, F. Evens, Jr. 225,343
Scoop shovel for unloading cars, J. S. Metcalf 225,521
Seaming machine, F. A. Welch 225,300
Semaphore, electric railway, J. Nesbitt 225,636
Service box, junction, S. R. Babcock 225,346
Sewing machine, J. E. Bertin 225,368
Sewing machine, button hole, J. H. Brown 225,300
Sewing machine motor, J. V. Morton 225,632
Sewing machines, presser foot and cord guide for button hole, T. S. L. Howard 225,608
Shaft and sheath, flexible, W. H. Gates 225,516
Sheet metal can, F. A. Walsh 225,460
Shell, time, M. Coloney 225,463
Shells, torpedoes, etc., time firing mechanism for, M. Coloney 225,469
Shirt, J. B. Kirkpatrick 225,616
Shoe fastening, W. Kraemer 225,477
Shoe holder and box draw, comb'd, C. A. Simonds 225,452
Shutter fastener, C. Garlich 225,470
Sign, transparent, H. Child 225,368
Sink trap, B. W. Anthony 225,309
Soldering apparatus, can, F. Westerbeck 225,348
Spark arrester, G. B. F. Cooper 225,372
Spoons, device for plating, P. Commanon 225,371
Steam boiler and furnace, E. H. McNiel 225,636
Steam engine, S. N. Silver 225,651
Steam generator, King & Drake 225,477
Steam generator, M. N. Lovell 225,400
Steam heater, S. F. Gold 225,473
Stove attachment, magazine, R. Hutchman 225,397
Stove, coal oil, W. B. Billings (r) 9,112
Stove grate, W. McIlvane 225,623
Stove, heating, O. W. Noble 225,494
Straw cutter gearing mechanism, J. Weichhart 225,671
Sugar moulding machine, C. H. Hersey 225,601
Suspender end, T. O. Foster 225,659
Tap valve, M. G. Gillette 225,471
Target ball, Ligowsky & Woeber 225,621
Telegraph signal box, fire alarm, J. M. Gardiner 225,391
Testing machine, G. Matheson 225,339
Thill coupling, H. Albers 225,302
Thrashing machine sieve protector, T. J. Hubbell 225,608
Tool, combination, C. S. Garrigus 225,387
Torpedo, marine, M. Coloney 225,465
Traction engine, Brown & Hoag 225,360
Trucks, safety hook for car, L. B. Stilson 225,660
Trunk, cross slatted, C. A. Taylor 225,404
Tube making machine, P. Reilly 225,642
Tubes, machine for corrugating metallic, S. Fox 225,386
Turbine gate, J. H. Maples 225,486
Type setting and distributing machine, P. Dolan 225,468
Valve, cylindrical, F. Winters, Jr. 225,677
Velocipede, railway, W. H. Fox 225,385
Washing machine, M. C. Greenland 225,460
Washing machine, J. F. Schlosstein 225,647
Watch stem winding and setting attachment, F. A. Vuille 225,442
Water motor, D. Drawbaugh 225,377
Water tank attachment, A. B. Castle 225,365
Wheat drill, S. Williams 225,345
Whip socket, H. B. Pitner 225,499
Wind engine, R. E. Strait 225,560
Windmill, N. Borden 225,364
Wood cutting tool, F. Hanson 225,474

DESIGNS.

Carpet, W. J. Gadsby 11,691
Carpet, D. McNair 11,693
Carpet, T. J. Stearns 11,691
Envelopes, H. C. Bainbridge 11,686
Fork and spoon handles, W. C. Beattie 11,690
Glasses, etc., bases or supports for, H. L. Palmer 11,695
Stage scene, W. A. Mestayer 11,679
Stocking fabric, J. E. Hanifen 11,692, 11,693
Suspender ends, W. F. Osborne 11,694
Umbrella handles, Hettor & Lasson 11,697, 11,698
Watch crowns, E. Hunziker 11,699

TRADE MARKS.

Braid pins, A. Cook 7,955
Cheese, Neuenschwander & Co. 7,954
Plows for breaking up and cultivating the soil, K. B. Whitman 7,952

English Patents Issued to Americans.

From March 12 to March 16, 1880, inclusive.

Coal picking and cutting machine, C. Morse, U. S. A.
Lamp, oil, R. Hitchcock et al., Watertown, N. Y.
Music leaf turner, F. L. Becker, Galveston, Texas.
Paper, repulping process for, C. Coon et al., Saugerties, N. Y.
Press regulator for water pipes, C. C. Barton, Rochester, N. Y.
Sewing machines, C. E. L. Holmes, New York city.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

PROGRESS OF INDUSTRIAL CHEMISTRY.—By J. W. Mallet. The latest and most approved processes, and the latest experimental results in the manufacture of the following important commercial products: Nitre, Potassium Chloride, Potassium Sulphate, Potassium Chlorate, Pyrochromate, Potassium Ferro-cyanide, Potassium Cyanide, Sodium Chloride, Sodium Nitrate, Sodium Sulphate, Borax, Ammonium Chloride, Calcium Chloride, Calcium Chlorate, and Magnesium Sulphate. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 214. Price 10 cents. To be had at this office and from all newsdealers.

MAGNETIC REACTIONS.—BY THEO. du Moncel. An interesting and instructive paper, by one of the most eminent of French electricians, demonstrating that the effects of magnetism, like those of electricity, are of two different natures, according as magnets act as currents or as charges in the static state. Static action and dynamic action defined. How static magnetism is distributed in a simple magnetic system shown by magnetic phantoms. The effects which result from reactions exchanged between a magnet and its armature. Apparatus for showing this. Magnetism, from a static point of view, shown to behave like electricity in a condenser. Magnetic condensation. Remanent Magnetism and how it differs from Condensed Magnetism. Illustrated with 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 217. Price 10 cents. To be had at this office and from all newsdealers.

AN EASILY MADE SMALL, STRONG, AND CHEAP BOILER for Little Steamboats. By H. K. Stroud. With an engraving. This excellent little boiler is made of wrought iron mercury flasks which may be readily obtained ready for use. Seven flasks are screwed together with ordinary gas fittings. This boiler has been used for a year past, with much success in the steam sharpie yacht Magnolia. Length of boat, 16 ft. 3 in.; beam, 4 ft. 6 in.; propeller, 19 inches diameter. For further description of boiler, boat, and engine, with method of securing the propeller shaft in stern post, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 182. Price 10 cents. To be had at this office and of all newsdealers.

THE EAR.—BY CHAS. H. BURNETT, M.D. A valuable paper, giving a report of four cases, among many others, in which is shown the beneficial effect derived from the prolonged and uninterrupted wearing of cotton pellets or artificial drum-heads, and which the author claims are the only useful kind of artificial drum-heads that have ever yet been devised. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 217. Price 10 cents. To be had at this office and from all newsdealers.

The Literary Revolution—History.

The Literary Revolution is emphatically in the interest of good literature and of sensible people. The trash, or pestilential stuff that makes up the cheap "*Libraries*" that flood the country, is utterly discarded. History, Biography, Poetry, Science—the best productions of the ablest writers the world has known, make up the volumes issued from our presses.

"**What is worth reading is worth preserving**," is one motto of the "Revolution." Notwithstanding the incomparably low prices, the best and handiest forms of volumes for reading and reference have been adopted, and the binding is always neat, strong and durable. The books are made for people who value contents rather than covers, and who want a limited sum of money to do them the greatest possible service.

Acme Library of History.

In this series it is proposed to present the works of the great authors whose writings have themselves become a part of history, and are associated in the minds of all readers with the nations whose history they narrate. We shall publish them at prices which, compared with usual rates, will be considered marvelously low.

The type in the *Acme* and in the *Aldus Editions* is the same. The paper in the *Acme Edition* is light but excellent in quality, and all that is generally desired. All of our binding is extra well done. The cloth binding is very neat, and will serve for many years of good usage. The half Russia is more elegant, as well as more durable, and to any one who can spare the small additional cost it is the much more desirable style. The *Aldus Edition* is printed with extra care, on heavy paper, with much wider margins. In this form our books will compare favorably, if they do not contrast favorably, with the best editions of the same works which have ever been published.

A Great Offer. As the best possible advertisement for our historical series will be to scatter the volumes among purchasers throughout the country, and thus demonstrate their unrivaled excellence combined with low price, we offer to the **first 10,000 purchasers** of Gibbon and Macaulay a **special discount of 10 per cent.** from the list prices given. *Readers of this paper who will cut out and return this slip*, with their remittance, within 10 days of receipt of this paper, will be sure of admittance at the first 10,000 rate. **For 10 Days.**

Macaulay's History of England.

History of England. By Thomas Babington Macaulay. In three volumes of about 7,200 pages, beautiful new large-faced brevier type, with very full index. Volume III., completing the work, ready March 31st.

Acme Edition, extra cloth, gilt title $1 50
Acme Edition, half Russia, sprinkled edges 2 25
Aldus Edition, half Russia, gilt top 3 00

Postage: Acme Edition, 36 cents; Aldus Edition, 36 cents.

For reading or reference we believe this to be the best edition of Macaulay ever issued. Readers will certainly prefer it to the five-volume edition which until recently was sold by the millionaire publishing house at $2.50 for the cloth, but lately reduced considerably by competition with us.

"The most popular historical work that ever issued from the English press. . . . As widely as our language has traveled these volumes have spread the reputation and the opinions of the author."—*Edinburgh Review*.

"Mr. Macaulay can afford to smile at all reviewers who affect to possess more than his own gigantic stores of information."—*Sir Archibald Alison*.

"Every page bears testimony to a degree of conscientious and minute research which no historian has ever surpassed."—*North British Review*.

"The style is faultlessly luminous; every word is in its right place; every sentence is exquisitely balanced; the current never flags."—*Westminster Review*.

"Macaulay is like a book in breeches."—*Sydney Smith*.

Milman's Gibbon's Rome.

History of the Decline and Fall of the Roman Empire. By Edward Gibbon. With Notes by H. H. Milman. A new edition, in five volumes, with very full index. The type is new, very clear, large-faced bourgeois. Volume V., completing the work, ready March 20th.

Acme Edition, extra cloth, gilt title $2 50
Acme Edition, half Russia, sprinkled edges 3 75
Aldus Edition, half Russia, gilt top 5 00

Postage: Acme Edition, 40 cents; Aldus Edition, 60 cents.

No other edition of Gibbon's Rome ever published in this country at less than four times its price will compare with this in beauty of typography, convenience of form and excellence of binding.

"He exhibits his ideas in the most splendid and imposing forms of which the English language is capable."—*Prescott*.

"As edited by Milman, a work for all time and all classes."—*London Monthly Review*.

"Gibbon, the architect of a bridge over the dark gulf which separates ancient from modern times, whose vivid genius has tinged with brilliant colors the greatest historical work in existence."—*Alison*.

"His work . . . is often something more than history, and above it; it is philosophy, it is theology, it is wit and eloquence, it is criticism the most masterly on every subject with which literature can be connected."—*Prof. Smyth*.

"It is a book, in spite of its faults, will always be a noble work."—*Guizot*.

"His eloquence and his great skill in representation give a charm and splendor to the thoughts which he wishes to disseminate."—*Schlosser* (translated by Davidson).

Knight's History of England.

Popular History of England, by Charles Knight. Complete in 4 vols. 12mo. Nearly 4,000 pages, beautiful new bourgeois type, with illustrations. Neatly and strongly bound in extra cloth, **$3.00**; in elegant and durable half Russia, gilt top, **$5.00**. Postage, 48 cents. Just ready.

This greatest work of one of the most justly celebrated authors of modern times covers the entire period of English history from earliest times to the present, in this respect differing from the works of Hume, Macaulay, Froude and others, each of which covers but a short period of time. Until recently it has not been published in this country at a less price than $35.00; in 1879 an edition printed in the same type as the one now issued by us, but without illustrations, was published at $10.00. As issued by us, KNIGHT'S ENGLAND, in type, paper, illustrations, printing and binding, is all that can be desired by the general reader.

"The best history of England for the general reader. For a single history which may serve for constant use and reference in the library, or for frequent reading, it is to be preferred to every other."—*Noah Porter*.

"We very cordially recommend these volumes. We know of no history of England so free from prejudice, so thoroughly honest and impartial, so stored with facts."—*London Athenæum*.

"Its literary merits are of a very high order; indeed, nothing has ever appeared superior, if anything has been published equal, to the account of the state of commerce, government and society at different periods."—*Lord Brougham*.

"Mr. Knight's book well deserves its name; it will be emphatically popular, and it will gain its popularity by genuine merit. It is as good a book of the kind as ever was written."—*Westminster Review*.

"The last and greatest literary work of his life. This history will remain, for many a long day, a standard work."—*London Times*.

"This work is the very best history of England that we possess."—*London Standard*.

Rollin's Ancient History.

Ancient History of the Egyptians, Carthaginians, Assyrians, Babylonians, Medes and Persians, Grecians and Macedonians, including a history of the arts and sciences of the ancients, by Charles Rollin. In one very large octavo volume, 1,318 double-column pages, very large clear type. Price, strongly bound in cloth, **$2.25**; in half Russia, sprinkled edges, **$2.75**; postage 42 cents.

For more than a hundred years ROLLIN'S ANCIENT HISTORY has ranked with the best of great historical works. The author has been especially noted for the intense interest with which he clothes his subject, so that his history has found its way into the home of the unlearned, as well as into the library of the scholar. The edition being issued by us is not only the best edition which is now offered to the public at any price, but is cheap, quite beyond comparison with the cheapest and most inferior editions.

Comic History of the United States.

By L. Hopkins. Copiously Illustrated by the Author, from Sketches taken at a Safe Distance. 12mo, Cloth extra, Ebony and Gold. Price, **50 cents**; Postage, 7 cents.

"When it first became noised abroad that he contemplated bringing out an Illustrated History of the United States, he was deluged with letters from a host of well-disposed persons, such as Thomas Carlyle, James Parton, Wendell Phillips, and others of more or less literary ability, offering to 'write up' to his pictures. Mr. Carlyle said he could do it nights. But the public was not to be trifled with, so he resolved to put his shoulder to the literary as well as the artistic wheel, as it were, and he flatters himself he has demonstrated in these pages that truth is more of a stranger than fiction."—*From Author's Preface*.

Verdict of Press and People.

"It is a marvel in book-making."—*Telegraph*, Pittsburgh.

"We country parsons can now fill our shelves."—*Rev. C. H. A. Bulkley*, Port Henry, N. Y.

"The American Book Exchange is solving the important problem."—*Evening Journal*, Chicago.

"We unhesitatingly indorse the American Book Exchange, and commend its course in bringing the best literature within reach of all classes."—*Central Baptist*, St. Louis.

"I regard Mr. Alden as a benefactor, and shall endeavor to disseminate a knowledge of him and his wares among my acquaintances."—*C. H. Bordman*, St. Paul, Minn.

"Has some rich relative left you a colossal fortune which you are spending in publishing books for the people at nominal prices? If so, I admire your taste. But won't the old-line publishers be glad when it is gone!"—*B. F. Compton*, Randolph, N. Y.

"Your lives will be intolerable without this work. Send and get it: we can't lend ours."—*State Journal*, Jefferson City, Mo.

"The American Book Exchange deserves credit for the part it is taking in popularizing standard literature."—*Christian Union*, New York.

"The cheapest publication ever given to the public."—*Courier*, Syracuse.

"A marvel of cheapness and excellence."—*Bookseller*, Chicago.

"Deserves hearty praise for neatness and attractiveness."—*Press*, Newark, N. J.

"The American Book Exchange is doing a very remarkable work."—*Journal*, Boston.

"Among the marvels in cheap reprints."—*Herald*, New York.

"The publishers are doing an invaluable service to the public."—*Chronicle*, Montpelier.

"Well selected and beautifully printed."—*Republican*, Springfield, Mass.

"The catalogue is a most astonishing exhibit of good things at low prices. An opportunity never before presented."—*Sunday Press*, Philadelphia.

"We were surprised into incredulity by the announcement. . . We have procured the volume, and find it even so."—*Religious Herald*, Richmond, Va.

"It is wonderful how such a useful and valuable work can be sold for so low a price."—*Presbyterian*, Baltimore.

"The Library of Universal Knowledge is as comprehensive as Appleton's splendid work, at just one tenth the price."—*Journal*, Lewiston, Pa.

"A marvel of good binding and printing."—*Daily Graphic*, N. Y.

"An acquisition to the library of the real lover of books, who values contents rather than covers. It is scarcely an exaggeration to say the prices average one-tenth of the standards from which they are reprinted."—*Pioneer Press*, St. Paul.

"Marvelously cheap."—*Courant*, Hartford, Conn.

"It is a rare book for the price."—*Christian Secretary*, Hartford.

"Remarkably cheap . . . exceedingly convenient and tasteful."—*Christian Intelligencer*, N. Y.

"A marvel in the book-making line."—*Presbyterian Banner*, Pittsburgh.

Other Standard Books.

Library of Universal Knowledge, 20 vols., $10.
Chambers's Cyclopædia of Eng. Literature, 4 vols., $2.
Plutarch's Lives of Illustrious Men, 3 vols., $1 50.
Geikie's Life and Words of Christ, 50 cents.
Young's Bible Concordance, 311,000 references (preparing), $2 50.
Acme Library of Biography, 50 cents.
Book of Fables, Æsop, etc., illus., 50 cents.
Milton's Complete Poetical Works, 50 cents.
Shakespeare's Complete Works, 75 cents.
Works of Dante, translated by Cary, 50 cents.
Works of Virgil, translated by Dryden, 40 cents.
The Koran of Mohammed, translated by Sale, 35 cts.
Adventures of Don Quixote, illus., 50 cents.
Arabian Nights, illus., 50 cents.
Bunyan's Pilgrim's Progress, illus., 50 cents.
Robinson Crusoe, illus., 50 cents.
Munchausen and Gulliver's Travels, illus., 50 cents.
Stories and Ballads, by E. T. Alden, illus., $1.
Acme Library of Modern Classics, 50 cents.
American Patriotism, 50 cents.
Taine's History of English Literature, 75 cents.
Cecil's Book of Natural History, $1.
Pictorial Handy Lexicon, 35 cents.
Sayings, by author of Sparrowgrass Papers, 50 cents.
Mrs. Hemans's Poetical Works, 75 cents.
Kitto's Cyclopædia of Bib. Literature, 2 vols., $2.
Smith's Dictionary of the Bible, illus., $1.
Works of Flavius Josephus, $2.
Health by Exercise, Dr. Geo. H. Taylor, 40 cents.
Health for Women, Dr. Geo. H. Taylor, 50 cents.
Library Magazine, 10 cents a number, $1 a year.
Library Magazine, bound volumes, 60 cents.
Leaves from the Diary of an old lawyer, $1.

Each of the above bound in cloth. If by mail, postage extra. Most of the books are also published in fine editions and fine bindings, at higher prices.

Descriptive Catalogues and Terms to Clubs sent free on request.

Remit by bank draft, money order, registered letter, or by express. Fractions of one dollar may be sent in postage stamps. Address

AMERICAN BOOK EXCHANGE,

JOHN B. ALDEN, Manager. Tribune Building, New York.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

METALS.

Important Books on Metals, Metal Mining, Metal Working, Assaying, Analysis, etc.

Bauerman.—A Treatise on the Metallurgy of Iron. Containing Outlines of the History of Iron Manufacture, Methods of Assay and Analysis of Iron Ores, Processes of Manufacture of Iron and Steel. Illus. 12mo, $2.00

Blinn.—Practical Workshop Companion for Tin, Sheet Iron and Copper Plate Workers. 100 illus. 12mo, $2.50

Byrne.—The Practical Metal Worker's Assistant. Comprising Metallurgic Chemistry; the Arts of Working all Metals and Alloys; Forging of Iron and Steel; Hardening and Tempering; Melting and Mixing; Casting and Founding; Works in Sheet Metal, the Processes Dependent on the Ductility of the Metals; Soldering, and the most improved Processes and Tools employed by Metal Workers. With the application of the Art of Electro Metallurgy to Manufacturing Processes. By Oliver Byrne. To which is added an Appendix, containing the Manufacture of Russian Sheet Iron. By John Percy. The Manufacture of Malleable Iron Castings and Improvements in Bessemer Steel. By A. A. Fesquet. With over 600 engravings, $7.00

Davies.—A Treatise on Metalliferous Minerals and Mining. By D. C. Davies, F.G.S., Mining Engineer, Examiner of Mines, Quarries, and Collieries. In one volume. 12mo, 438 pp. Illustrated by 148 engravings of Geological Formations, Mining Operations and Machinery, drawn from the practice of all parts of the world. $5.00

DeKoninck.—Dietz.—A Practical Manual of Chemical Analysis and Assaying: As Applied to the Manufacture of Iron from its Ores, and to Cast Iron, Wrought Iron, and Steel, as found in Commerce. By DeKoninck, Dietz, and Mallet. American Edition, with Notes and an Appendix on Iron Ores, by A. A. Fesquet. 12mo, $2.50

Gee.—The Practical Gold Worker. The Art of Alloying, Melting, Refining, Reducing, Coloring, Collecting and Refining; the Processes of Manipulation, Recovery of Waste, Chemical and Physical Properties of Gold, Mixing of Alloys, Solders, Enamels, etc., etc. 12mo, $1.50

Gee.—The Silversmith's Hand Book. Instructions for Alloying and Working Silver; Refining, Melting, Solders, Alloys, Imitations, etc. Illustrated. 12mo, $3.50

Guettier.—Fesquet.—A Practical Guide for the Manufacture of Metallic Alloys. Comprising their Chemical and Physical Properties, with their Preparation, Composition, and Uses. From the French of A. Guettier, by A. A. Fesquet. 12mo, $3.00

Gruner.—Study of Blast Furnace Phenomena. By M. L. Gruner, Prof. of Metallurgy, Ecole des Mines. 8vo, $2.50

Kirk.—The Founding of Metals. Illustrated. 8vo, $2.50

Kobell.—Erni.—Mineralogy Simplified: A short method of Determining and Classifying Minerals, by means of simple Chemical Experiments in the Wet Way. From the German of F. Von Kobell, with an Introduction to Blowpipe Analysis, and other additions. By Henri Erni, M.D. 12mo, $2.50

Landrin.—A Treatise on Steel. Comprising its Theory, Metallurgy, Properties, Practical Working, and Use. From the French, by A. A. Fesquet. 12mo, $3.00

Larkin.—The Practical Brass and Iron Founder's Guide. A Concise Treatise on Brass Founding, Moulding, the Improvements in the Manufacture of Iron and Steel by the Bessemer Process, etc., etc. By James Larkin. 12mo, $2.25

Lieber.—Assayer's Guide; Or, Practical Directions to Assayers, Miners, and Smelters, for the Tests and Assays, by Heat and by Wet Processes, for the Ores of all the Principal Metals, of Gold and Silver Coins and Alloys, and of Coal, etc. 12mo, $1.25

Napier.—Manual of Electro Metallurgy, Including its Application to Manufacturing Processes. Illustrated. 8vo, $2.00

Normandy.—The Commercial Handbook of Chemical Analysis; or, Practical Instructions for the Determination of the Intrinsic or Commercial Value of Substances used in Manufactures, in Trades, and the Arts. Edited by H. M. Noad. 12mo, $5.00

North.—The Practical Assayer, containing Easy Methods for the Assay of the Principal Metals and Alloys. Designed for Explorers and those interested in Mines. By Oliver North. 12mo, $2.50

Orton.—Underground Treasures: How and Where to Find Them. A Key for the Ready Determination of all the Useful Minerals within the United States. By James Orton, A.M. Illustrated, 12mo, $1.50

Overman.—The Manufacture of Steel. By A. A. Fesquet. 12mo, $1.50

Osborn.—Metallurgy of Iron and Steel, theoretical and practical, in all its branches, with special reference to American materials and processes. Illustrated by numerous large folding plates and wood engravings. 8vo, $15.00

Perkins and Stowe.—New Guide to the Sheet Iron and Boiler Plate Roller. $2.50

Phillips and Darlington.—Records of Mining and Metallurgy. Illustrated. 12mo, $2.00

Percy.—Manufacture of Russian Sheet Iron. 8vo, Paper, $0.50

Roseleur.—Galvano-plastic Manipulations. A practical guide for the Gold and Silver Electro-plater and the Galvano-plastic Operator. 127 engravings. 495 pages, 8vo, $6.00

Tables Showing the Weight of Round, Square, and Flat Bar Iron, Steel, etc., by measurement. $0.63

Urbin and Brull.—Practical Guide for Puddling Iron and Steel. 8vo, $1.00

Vail.—Galvanized Iron Cornice Workers' Manual. Containing instructions in laying out the different Miters and making patterns for all kinds of plain and circular work. Illustrated. 4to, $5.00

Warn.—The Sheet-Metal Worker's Instructor. For Zinc, Sheet-Iron, Copper, and Tin-Plate Workers. To which is added an Appendix, containing instructions for Boiler Making, Measurement of Surfaces and Solids, Rules for Calculating the Weights of different figures of Iron and Steel, Tables for the Weights of Iron, Steel, etc. Illustrated by 32 plates and 37 wood engravings. 8vo, $3.00

Will.—Tables of Qualitative Chemical Analysis. With an Introductory Chapter on the Course of Analysis. By H. Will. Edited by C. F. Himes. 8vo, $1.50

Wohler.—A Hand-Book of Mineral Analysis. By F. Wohler. Edited by Henry B. Nason. Illustrated. 12mo, $3.00

☞ The above or any of our books sent by mail, free of postage, at the publication prices.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo, a Catalogue of Books on DYEING, CALICO PRINTING, WEAVING, COTTON and WOOLEN MANUFACTURE, 4to; Catalogue of a choice collection of PRACTICAL, SCIENTIFIC, and ECONOMIC BOOKS, 4to; List of Books on STEAM AND THE STEAM ENGINE, MECHANICS, MACHINERY, and ENGINEERING, 4to; List of Important Books on METALLURGY, METALS, STRENGTH OF MATERIALS, CHEMICAL ANALYSIS, ASSAYING, etc., 4to; List of Books on MINING, MINING MACHINERY, COAL, etc., 4to; two Catalogues of Books and Pamphlets on SOCIAL SCIENCE, POLITICAL ECONOMY, BANKS, POPULATION, PAUPERISM, and kindred subjects; a Catalogue of recent additions to our stock of PRACTICAL SCIENTIFIC AND TECHNICAL BOOKS; as well as a List of LEADING BOOKS ON METAL MINING, METALLURGY, MINERALOGY, ASSAYING, AND CHEMICAL ANALYSIS, sent free to any one who will forward his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.

ROCK DRILLING MACHINES AND AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL Co.
SEND FOR PAMPHLET. FITCHBURG MASS.

Lathes, Planers, Shapers
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

PORTLAND CEMENT,
From the best London Manufacturers.
K. B. & S., AND BEHRENS' CEMENTS.
For sale by JAMES BRAND, 85 Beekman St., New York.

SEE SPECIAL TANITE ADVERTISEMENT
ON INSIDE PAGE.

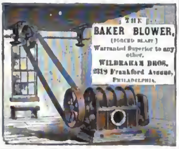
THE HOLLY SYSTEM OF STEAM HEATING FOR CITIES AND VILLAGES. HOLLY STEAM COMBINATION CO. LIMITED, LOCKPORT N.Y.

The New York Ice Machine Company,
21 COURTLANDT STREET. Room 28.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more Ice. Uses only ¼ water of condensation. No Pressure at rest. Pressure in running, 14 pounds. Self-lubricating. No leaks, non-inflammable. No action on Metals. Easy Attendance.

IMPLEMENTS, MACHINERY, ETC.
Catalogues, prices and Agency terms solicited. Unexceptional references. OSKAR NETZLER, Agent in Brisbane, Queensland, Australia.

COLUMBIA BICYCLE.
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of The Bicycling World.
THE POPE M'F'G CO.,
89 Summer Street, Boston, Mass.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.



DROP HAMMERS.
STILES & PARKER PRESS CO., Middletown, Conn.

Working Models
And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.

ROOTS' NEW IRON BLOWER.

POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED
IS SIMPLER, AND HAS
FEWER PARTS THAN ANY OTHER BLOWER.
P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 8 Dey Street,
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street, NEW YORK.
☞ SEND FOR PRICED CATALOGUE.

WIRE ROPE
Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.
Wheels and Rope for conveying power long distances. Send for circular.

A New Spinning Band.
ROWBOTTOM'S PATENT DOUBLE LOOPED SPINNING BAND. Suitable for all kinds of Spinning and Doubling Frames for Woolen, Worsted, Cotton, Flax, or other fibrous substances. IS FREE FROM KNOTS, neat, speedily adjusted, runs steadily, and avoids the annoyance of Lint. Price, fifty cents per pound delivered at the mill. Sample orders solicited. State kind of machinery, diameter of Driving Cylinder, and actual length required when in operation.
STODDARD, LOVERING & CO., Sole Agents, No. 10 Milk Street, Boston, Mass.

52 Gold Crystal, Lace, Perfumed, and Chromo Cards, name in Gold & Jet 10c. Clinton Bros, Clintonville, Ct.

NEW FLORAL AUTOGRAPH ALBUM.
Illustrated with Birds, Scrolls, Ferns, Flowers, etc. 48 Pages. Covers and edges elegantly Gilded, also 47 select quotations, all for 15c.; including Outfit, 25 styles Photograph and Visiting Cards, 3c., post-paid (stamps taken). Agents wanted. G. W. BOCEMMEDER, West Haven, Conn.

WORK SOLE SHOES.
The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send stamp for circular and price list.
CHAS. W. COPELAND,
122 Summer St., Boston, Mass.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

RAILROAD DEPOTS ... WHARF SHEDS, SUGAR HOUSES ... COTTON STORES, PUBLIC MARKETS ... HOUSES, WALTER C. BERG ... GLASGOW—SCOTLAND.

BOILER COVERINGS.
Plastic Cement and Hair Felt, with or without the Patent "AIR SPACE" Method.
ASBESTOS MATERIALS,
Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John Street, and Foot of E. 9th Street, New York.

ORGAN BEATTY PIANO
New Organs 13 Stops, 3 set Golden Tongue Reeds, 5 Oct's, 2 Knee Swells, Walnut Case, warnt'd 6 years, Stool & Book $98. New Pianos, $143 to $255. Newspaper sent Free. Address Daniel F. Beatty, Washington, New Jersey.

"BUCKEYE" LAWN MOWER.
The lightest and easiest running MOWER ever made.
STRICTLY FIRST CLASS.
MAST, FOOS & CO.,
Springfield, Ohio.
Send for catalogue.

Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

The Asbestos Packing Co.,
Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:
PATENTED ASBESTOS ROPE PACKING,
" " LOOSE "
" " JOURNAL "
" " WICK "
" " MILL BOARD,
" " SHEATHING PAPER,
" " FLOORING FELT,
" " CLOTH.

PATENT

Galvanized Iron Tackle Blocks
For all Hoisting Purposes. Tight, Easy Running, Durable, superior to all Wood Blocks. Cheaper than all other Iron Blocks.
PROVIDENCE TOOL CO.,
Providence, R. I.

GENUINE BABBITT METAL,
Fine Brass and Composition Castings,
E. STEBBINS M'F'G CO., SPRINGFIELD, MASS.

The Rodier Patent Single Iron Plane.

Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

AIR COMPRESSORS.
THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.

BIG PAY to sell our Rubber Printing Stamps. Samples free. Taylor Bros. & Co., Cleveland, O.

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought
STRUCTURAL IRON.
It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders, on application.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

A USEFUL UNITED STATES PATENT FOR SALE. Address JOSEPH KELLER, Norwalk, Conn.

H.W. JOHNS' ASBESTOS ROOFING.
The Asbestos Roofing (with white or light gray Fireproof coating) is now in use in all parts of the world, and is the only reliable substitute for tin. It is adapted for steep or flat roofs in all climates. It costs only half as much as tin, and can be easily applied by any one.
☞ Note the address, send for samples, and be sure and get the genuine, which is manufactured only by
H. W. JOHNS M'F'G CO.,
87 Maiden Lane, New York,
sole manufacturers of genuine Asbestos Liquid Paints, Boiler Coverings, etc.
Descriptive Price Lists free by mail.

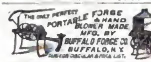
"RELIABLE"
Engines a complete success. Prices still 40 per cent. below those of other makers. Unequaled for efficiency, simplicity, and durability. Prices from $150 for 10 H. P., to $400 for 50 H. P. All complete, with Governor, Pump, and Heater.
Address, for circular,
HEALD, SISCO & CO.,
Baldwinsville, N. Y.

ROOFING.
For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.

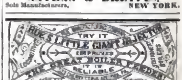
$777 A YEAR and expenses to agents. Outfit Free. Address P. O. VICKERY, Augusta, Maine.

BROWN'S PAT. SPLIT PULLEYS
Shafts, Hangers.
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

Gear Molding without Patterns
Scott's Gear Moulding Machines,
AIR COMPRESSORS & ROCK DRILLS.
DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
FOOT OF W. 13th ST., North River, NEW YORK.
ESTABLISHED 1841.



FRIEDMANN'S PATENT
EJECTORS
Are the cheapest and most effective machines in the market for
Elevating Water and Conveying Liquids
from Mines, Quarries, Ponds, Rivers, Wells, Wheel Pits; for use in R. R. Water Stations, Factories, etc. They are splendidly adapted for conveying liquids in Breweries, Distilleries, Sugar Refineries, Paper Mills, Tanneries, Chemical Works, etc. Send for illus. catalogue to
NATHAN & DREYFUS,
Sole Manufacturers, NEW YORK.

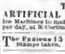


BOYLE ICE MACHINE CO.,
10 N. Jefferson St., Chicago, Ill.
The best Ice and Refrigerating Machines of all sizes and for all purposes guaranteed. Send for circular.

TELEPHONE Works 1 mile. Price ... Circulars free. HOLCOMB & Co., Mallet Creek, ...

THE PICTET
ARTIFICIAL ICE COMPANY, Limited.
Ice Machines to make from 25 pounds per hour to 50 tons per day, at 22 Cortlandt St., New York. P. O. Box 3083.

The Famous 15 Puzzle by mail 10c. Agts. Wanted. Stamps taken. Dunbar & Mitchell, Bristol, Conn.



Furnace Hoist.

ELEVATORS.
All kinds of Hoisting Machinery a specialty. Steam, Hydraulic, and Belt Power for Passengers and Freight. Iron Furnace Lifts, Portable Hoists. STOKES & PARRISH, 30th and Chestnut St., Phila. Pa.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements,
from 10 to 1,000 H. P.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 17. [NEW SERIES.] NEW YORK, APRIL 24, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

THE MANUFACTURE OF MÉGE OLEOMARGARINE AND OLEOMARGARINE BUTTER.—[See page 258.]

Fig. 1.—One Day's Churning.—Butter Working and Salting. Fig. 2.—View of Commercial Manufacturing Company's Works. Fig. 3.—Churning Room. Fig. 4.—Melting Room.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included.......... $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, APRIL 24, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 225.

For the Week ending April 24, 1880.

Price 10 cents. For sale by all newsdealers.

ELECTRO-HORTICULTURE.

It has often been remarked by Arctic explorers that plants which require several months to ripen their fruit in temperate climates complete the same round of budding, blooming, and maturing in a few weeks under the continuous sunshine of the Arctic summer. A corresponding rapidity of growth is shown by annuals in sub-Arctic latitudes, as in northern Norway, where the summer sun, though never reaching a high altitude, yet remains above the horizon from sixteen to twenty hours a day.

A species of corn which flourishes in Canada failed to ripen in Kentucky, though the warm season there is some weeks longer than in Canada. The superior rapidity with which vegetation pushes forward during periods of full moon and light nights has also been widely noticed; these facts of general observation, with others of a more experimental character, going to show that many of the plants of our temperate climate thrive in proportion to the duration of the daily (direct or indirect) sunshine they enjoy, rather than according to the temperature of the air.

A curious confirmation and extension of these observations in regard to the influence of light upon vegetation is furnished by the recent experiments of Dr. C. W. Siemens, testing the influence of the electric light upon certain plants. These experiments were described by Dr. Siemens at considerable length at a late meeting of the Royal Society in London. According to the report of the London *Times* the method pursued by Dr. Siemens was to plant quick-growing seeds and plants, such as mustard, carrots, ruta-bagas, beans, cucumbers, and melons in pots, dividing the pots into four groups, one of which was kept entirely in the dark, one was exposed to the influence of the electric light only, one to the influence of daylight only, and one to daylight and electric light in succession. The electric light was applied for six hours each evening—from 5 to 11—and the plants were then left in darkness during the remainder of the night. The general result was that the plants kept entirely in the dark soon died; those exposed to the electric light only or to daylight only throve about equally; and those exposed to both day and electric light throve far better than either, the specimens of mustard and of carrots exhibited to the society showing this difference in a very remarkable way. Dr. Siemens considers himself as yet only on the threshold of the investigation, but thinks the experiments already made are sufficient to justify the following conclusions:

1. That electric light is efficacious in producing chlorophyl in the leaves of plants, and in promoting growth. 2. That an electric center of light equal to 1,400 candles placed at a distance of two meters from growing plants appeared to be equal in effect to average daylight at this season of the year; but that more economical effects can be obt[illegible] by more powerful light centers. 3. That the carbonic [illegible] nitrogenous compounds generated in diminutive q[illegible] in the electric arc produce no sensible deleterious effects upon plants inclosed in the same space. 4. That plants do not appear to require a period of rest during the twenty-four hours of the day, but make increased and vigorous progress if subjected during daytime to sunlight and during the night to electric light. 5. That the radiation of heat from powerful electric arcs can be made available to counteract the effect of night frost, and is likely to promote the setting and ripening of fruit in the open air. 6. That while under the influence of electric light plants can sustain increased stove heat without collapsing, a circumstance favorable to forcing by electric light. 7. That the expense of electro-horticulture depends mainly upon the cost of mechanical energy, and is very moderate where natural sources of such energy, such as waterfalls, can be made available.

In the discussion which followed the reading of the paper it was pointed out that the evidence seemed to show the practical identity of solar and electric light with respect to their action on vegetation; and it was suggested that the method of subjecting plants to electric light might afford great facilities for the scientific investigation of the influence exerted by light, as compared with other agencies, in promoting the formation of the active principles or most valuable constituents of plants, such as the quinine of the cinchona bark, the gluten of wheat, etc. Before concluding his observations, Dr. Siemens placed a pot of budding tulips in the full brightness of an electric lamp in the meeting room, and in about forty minutes the buds had expanded into full bloom.

THE MIGRATION OF THE GREAT AMERICAN DESERT.

The irrepressible conflict between herders and farmers along the Kansas and Nebraska frontier is steadily growing in magnitude, and on its issue depends the future of the great tract of country between the 100th meridian and the Rocky Mountains. The stock raisers and government surveyors pronounce the region fit only for pasturage lands, and ask that it be leased in large tracts to herders; the farmers claim, on the other hand, that the region embraces some of the finest farm lands in the country, and insist that it shall be held subject to homestead pre-emption and timber claim entry.

As spokesman for the latter party, Professor C. D. Wilber, of Wilber, Saline County, Nebraska, has been giving a correspondent of the *Inter-Ocean* a history of the controversy, and no end of evidence that the desert makers are wholly and designedly in the wrong. The desert country reported as lying west of the 100th meridian has, he maintains, no real existence. The entire region west of the Missouri River was formerly held under the same reproach. Now the country bears magnificent crops of corn, wheat, rye, oats, barley, in many instances exceeding in productive capacity the famous valleys of the Mohawk, the Genesee, the Muskingum, and the Miami.

Touching the agricultural value of this region and the recent change of opinion regarding it by those who have learned its value, Prof. Wilber said:

"Only eight years ago, being one of an excursion party—chiefly the pioneers of the M., K. and T. R. R. from New York city, I made an extended tour over the plains toward the Colorado line. Mayor Opdyke said: 'The country is, indeed, beautiful; but what a pity it is so worthless. Is there not some way to overcome this desert condition? It must remain a waste thousands of years. The Indians are welcome to it, if only they will keep it.' Messrs. Skiddy, Schell, Parsons, Dickinson, and other men of great wealth, returned from the Sahara confirmed in their traditions, saying, 'It will never be worth a dime per acre.'

"To-day, ten years later, the New York capitalists are pushing railway lines and branches with unparalleled rapidity, eager to be first in possession of the same country, no longer a desert, dry, sterile, worthless, but, as they now know it to be, the best portion of the continent.

"The Boston capitalists were quite as the New Yorkers. Twelve years ago the wise men of the 'Hub' projected their first Nebraska railroad, from Plattsmouth to Fort Kearney, nearly 200 miles, based upon the usual land grant of 12,800 acres per mile of track. But in this desert Nebraska, as they judged, the less land the better. In the bill conveying the grant it needed only five or ten lines, or a score of words, to have secured gratis the entire route through the great Republican valley, with the accompanying grant of over 4,000,000 acres of the richest lands in America, but by them, at that time, not considered worth asking for. And now, after ten years, the aforesaid wise men of Boston, in the autumn of 1879, passed over the same route with a corps of engineers to choose the route, purchase the right of way, and make ready to spend $10,000,000. They *knew* the country west of Kearney would never be habitable except by Indians, gophers, and owls."

The government experts who have described the country as fit only for pastoral uses, have done so, Prof. Wilber claims, without actual study of the plains they have condemned:

"Whatever they have put on record in their reports mostly concerns the mountainous regions of Wyoming, Colorado, Utah, and New Mexico.

"The plains or middle country of Dakota, Nebraska, Kansas, Eastern Colorado, and Wyoming, have either been wholly neglected or dismissed after hasty visits, with a brief report made up of most superficial and erroneous observations.

"What apology can either Prof. Hayden or Major Powell offer for their notes on the region just referred to?

"Speaking of Nebraska, Hayden says:

"'For 150 to 200 miles west of Omaha the soil is very fertile and can hardly be surpassed, but beyond that there is an absence of both wood and water, which will render it impossible to cultivate the western half of the State of Nebraska successfully.'

"Major Powell, of the United States Geological Corps, says: 'There is not of available land belonging to the United States enough left to make an average county in Wisconsin.'

"There are to-day in Western Nebraska and Kansas, far beyond the 100th meridian, many thousand prosperous farmers, whose full granaries give the lie to the statements of the government explorers, Hayden and Powell."

Last year the acreage of new farms all along the western border of the settlements was enormous, bringing under cultivation a strip ten miles wide, extending north and south through Dakota, Nebraska, and Kansas. Previously the country was barren, but rain follows the plow, as it has heretofore, across a belt 350 miles wide.

"The first settlers, twenty-five years ago, placed the desert limits just west of the Missouri River counties. These being occupied, the desert line was established on the Big Blue, 70 miles beyond. But the farmer invaded the Big Blue Valley, and the desert line was established near Kearney, 190 miles west of Omaha. But the irrepressible plow broke the barrier in so many places that the desert makers fled with their line to the 100th meridian, determined to have and enjoy a desert. But hordes of farmers have gone far beyond and secured farms whose products equal those of Iowa or Illinois."

The desert was a reality; but agriculture has practically abolished it.

"The owners of the great herds of cattle are constantly obliged to retreat before the immense army of emigration from the Canadas, the Eastern and Middle States, and especially from Wisconsin, Illinois, Iowa, and Minnesota.

"Coming with their families and their farming outfit, generally without previous inspection, they become squatters upon any lands not taken at the Land Office. As the land laws are impartial, who comes first is first served, and the herd owner, though a millionaire, as some are, is, much to his disgust, forced further out on the plains.

"The reactions that follow are obvious. The ranchmen or herders insist that the country will never raise grain, is only fit for cattle and sheep, is a desert, without water for irrigation, and insufficient rain. It is by nature's law the herdsman's country, and the national law must be made to coincide. To bring these laws into effect is the animus of

the present land movement, and to prepare the way for it is the object of the Public Land Commission sent out by the last Congress, with Messrs. Hayden, Powell, and Clarence King in charge. These gentlemen have made their preliminary report, full of desert as usual. The two former are professional desert makers, and Clarence King is a member of the firm of Davis & King, who have a herd of over 20,000 cattle in this desert—'the herdsman's paradise.' The report to Congress was, of course, a foregone conclusion."

The prize in this contest is the control of nearly 500,000,000 acres of land, which the herdsmen want to have divided into large tracts and leased at low rates for grazing; while their opponents, who last year carved 100,000 new farms out of the desert, are equally anxious that the present quarter-section system shall be preserved.

The top soil of the larger part of the disputed region is identical with the loess of the Rhine Valley and of the most fertile parts of China, and lies from two to five feet deep, slightly colored with burnt or decayed vegetation. The subsoil is the same in composition but uncolored, showing its original light brownish-yellow hues. During the present year the pioneer farmers promise to exceed the work of last year in winning over a broad belt of the "desert" by covering the ground with crops and making way for a still further advance of rainfall.

THE MINING DEBRIS PROBLEM IN CALIFORNIA.

A recent report to the U. S. Chief of Engineers, by Lieutenant-Colonel G. H. Mendell, reviews at considerable length the changes wrought in the Sacramento River and its tributaries by placer and hydraulic mining, and proposes a system of dams for arresting the destruction of those streams and the progressive covering of their valleys with mining debris. Already the alluvial lands thus buried are estimated at 14,600 acres; and the river beds have been raised so high that they are constantly making new channels, causing heavy losses to farmers and the apprehensions of graver disasters in the future. The chief source of the trouble at present is hydraulic mining, placer mining having for the most become a thing of the past, and quartz mining adding but little to the debris. On this point Lieutenant-Colonel Mendell says:

"Although the hydraulic miner is now unquestionably responsible for the continual accretions that raise the levels of the beds of the watercourses year by year, yet the history of these deposits show that he is not responsible for all that is past. Hydraulic mining, in the effective form it now presents, is of quite modern growth. The earlier mining done from 1848 to 1860 was done by manual labor. Water was used to work out the gold, but was not used to excavate to any great extent. The water was not used under pressure. During these years, and especially during the first five or six years, counting from 1848, many thousands of men were employed in placer mining all through the gold districts. During all these years there was no great flood. The winter of 1861–62 was the occasion of the severest flood California has known since 1848. This flood found all the little gulches and the beds of larger streams stored with the material resulting from ten years' mining. This freshet brought the sand and gravel down in immense quantities. Whatever filling of the channel may have taken place previous to this time, it appears to have escaped notice. The winter of 1865, which gave high water, increased the evil. The placer mining had been nearly if not entirely exhausted by this time. Each successive flood has made things worse and worse."

The quantity of earth washed into the rivers by hydraulic mining is shown in the following estimates:

An inch of water running for 24 hours is taken to be 2,230 cubic feet. On the San Juan ridge, between the South and Middle Yuba, the State Engineer reports that in the year beginning November, 1878, 2,819,317 inches of water were used, while the quantity ascertained to have been used during the same time in the drainage basin of the Yuba is 5,893,962 inches.

An inch of water will excavate at all rates from 1 to 7 or 8 cubic yards of earth. The Spring Valley mines at Cherokee have been excavated to the extent of 23,000,000 cubic yard in 7 years, with an average quantity of 2,350 inches. Allowing 310 days to the year, the daily excavation for an inch of water is about 4 yards. The material here is very light, mostly sand, fine gravel, and clay in cliffs 400 feet high. The grades of the sluice is perhaps an average, being 1 foot in 24.

It would, perhaps, be an excessive allowance to apply this rate of excavation to the Yubas. It is, however, within the probable limits of truth to place the amount of material excavated in the basin of the Yuba at 2½ yards to the inch. This allowance makes they early amount placed in the stream and its tributaries at 14,000,000 or 15,000,000 cubic yards. On the other mining streams, the Feather, Bear, and American, there is no reliable information as to the amount excavated and deposited in the streams.

The attempt has been made to estimate the quantity of material in the Yuba and Bear rivers that has not yet reached the navigation lines, but which lies in the path of the floods, and is, therefore, liable to be washed farther and farther in greater or less degree, by every freshet. These deposits are the result of past mining. If no more were added, they are yet capable of doing a great injury to the water courses below.

The amount lying in the bed of the main Yuba and its branches, above the Yuba mill, is 49,263,200 cubic yards. The amount below the Yuba mill as far as Marysville, 14,000 acres covered, average depth assumed to be 4 feet, is 94,288,664. Total, 143,551,864.

On the Bear River the estimate is 148,248,000, of which 62,088,000 lies in the plains, and 86,160,000 cubic yards are in the bed of the stream above the foothills. This estimate makes the total amount in the two streams to be 291,799,864 cubic yards. It is not pretended that this estimate is accurate. It could not be so without boring the deposits in thousands of places. It is made from the best information available. Its use, in its imperfect accuracy, is to convey to those who have not the opportunity of seeing it some conception of the enormous dimensions of the phenomenon.

The character of this deposit has already been defined. It is sand, gravel, "slickens" (fine sand and clay), and stones.

The part that has reached the plains to this time is sand, gravel, and slickens. The layer of gravel and cobbles remain, as yet, in the foothills. There is some coarse gravel in the Yuba, four or five miles below the Yuba mills.

The Yuba having been filled 125 feet at Smartsville, and perhaps 15 feet at Marysville, the slope of the river between these points, a distance of 18 miles, has been increased 110 feet, which is about 6 feet per mile. This about doubles the original slope.

This tendency to increase the slope of this part of the river brings the gravel lower and lower. This is counteracted, to some extent, by the great breadth of the stream in the plains at high water. Small gravel is, however, found now in small quantities within three or four miles of Marysville. With the increase of slope under the influence of freshets we must expect this gravel to reach first the Feather, and in due time the Sacramento. Once in either of these streams in considerable quantities, it cannot be expected to move under the influence of the current, or if it did, the effect would be to transfer it to a more objectionable place. In the Feather the pools that formerly alternated with ripples have been filled. It is estimated by the State Engineer Department that there is a deposit in the Feather River of 40,000,000 cubic yards, and in the Sacramento below the mouth of the Feather something like 100,000,000 cubic yards.

Great as are the quantities of sand and gravel already washed into the streams, the remaining gold-bearing gravel ranges contain vastly more, which future mining is sure to displace. It thus becomes a matter of vital importance to arrest the flow of detritus into and upon the river valleys, which can be done only by storing it in places where it can do little harm. To this end storage reservoirs are proposed in the foothills of the Sierra Nevadas, to be formed by throwing dams, or more correctly rip-rap obstructions, across the streams into which the material is discharged from the mines. The stones required are found abundantly in the foothills, and they have only to be loosely piled together, the slopes of the [illegible] depend upon the size of the material. Th[illegible]tion of dams of this sort is inexpensive, involvin[illegible]killed labor. It is estimated that in the first three dams of the Yuba River 1 cubic yard of stone will impound 242 cubic yards of detritus. For the other dams, six or more in number, 1 cubic yard of stone will impound about 580 yards. The estimated average cost of the first three dams is put at $1.50 per yard; for the remaining dams $2.50 a yard. For the lower dams the total average cost will be about three-fifths of a cent for each cubic yard of detritus stored. For the upper dams, the bed of the stream having been brought to a slope of 10 feet to the mile, the expense of storage will be reduced to less than half a cent a yard. No calculation has been made for the American or the Bear River, but the cost for these is thought to be less, for the reason that the amount of mining on them is less than on the Yuba.

For the further protection of the Sacramento River the filling up of one of the low districts between the Feather and the American river by its conversion into a storage basin, is suggested. Some parts of this land are represented to lie as much as 20 feet below the banks. The average depth has been estimated at 12 feet. The area is said to be in the neighborhood of 60 square miles. Admitting these statements to be exact, the storage capacity of this basin, filled to the banks, will be about 700,000,000 cubic yards.

It is believed to be practicable to turn the Feather and American rivers into this basin, and make them deposit therein the sands which they bring down. No objection is now seen to turning the American in this way. It is not navigable. The diversion could not fail to be beneficial to the Sacramento.

The Feather differs from the Sacramento in being a larger stream, and consequently likely to be more expensive to divert, and also in being navigable. It is now the outlet for a certain district of country and maintains a small commerce.

It is recommended that a full investigation of this problem be made as soon as possible for future guidance.

The only alternative to these works for arresting the flow of mining *debris* is the entire cessation of hydraulic mining; and even with that heroic remedy it would still be necessary to restrain the many millions of cubic yards of detritus already lying in the path of freshets, which year by year bear down vast quantities of sand and gravel to the destruction of the lower valleys.

Sudden Death from Electric Shock.

A serious illustration of the risk attending electric shocks, even when apparently slight, occurred recently in New Haven, Conn. A gentleman was induced to try a shock "just for fun," from the machine of an itinerant peddler of electricity. He turned away, but had not gone far when he was seen to stagger and fall. He was picked up unconscious, and remained so until he died, two days after. The physicians pronounced it a case of apoplexy, superinduced by the electric shock.

Those Dreadful Moles.

On a visit to the country, a few miles from the city, the other day, we crossed a lawn perforated with holes, and the entire surface so ridged by moles that in walking over it the foot sank deep into the sod at every step. We have never before known these pests to pursue their digging operations through the winter, in this region, and are led to inquire if it is owing to the open winter, or to an increase in the number of these rodents, which has caused the apparent destruction of a cherished lawn. It is discouraging enough to have to contend with these pestiferous diggers from May till November, but now to find them burrowing along the surface in midwinter is an annoyance only the best of natures can cheerfully endure.

Many agricultural writers contend that moles are beneficial to the farm and garden. They may be, but their usefulness is a subject we are not disposed to discuss at this time; but what we would like to know is, what better methods there are for producing mortality among them than the various kinds of traps and other appliances which have been described in these columns. Inventors will find mole annihilators a profitable field for their genius.

Artesian Well at the Fifth Avenue Hotel, New York.

For some time past a drill has been gradually working its way down toward the center of the earth from the basement of the Fifth Avenue Hotel, whose proprietors hope to reach a supply of fresh water for that establishment and avoid having to pay the tax for croton. The well has already reached a depth of more than 1,000 feet, and is deepening at the rate of about 20 feet per day. A *Tribune* reporter called to see the drilling recently, and gives the following account:

Passing through the wide entrance on Twenty-fourth street, where the marketing of the hotel is delivered, and picking his way through a labyrinth of wagons laden with dressed meats, fowls, vegetables, etc., the reporter found himself in front of a partially inclosed space in which the engine, steam pump, and drill were at work. The drill proper, as the engineer explained, consists of a steel pipe, ¼ inch in thickness, 2½ inches in diameter, and about 11 feet long, in the cutting end of which are set fifteen diamonds, ranging in size from one to three and one-half carats. These cut a circle down into the rock, of which the "core" goes into the pipe—to be drawn up when the section is filled. The drill has section after section screwed to it as the depth of the well increases; it is forced downward by hydraulic pressure, and is turned by the engine. Whenever the drill requires examination, or the removal of the core, each section must be unscrewed as it is brought up, and joined again, piece by piece, when the drill is to be lowered for farther work. The diamonds become blunted after a certain amount of cutting, and must either be reset or replaced. The durability of the drill varies with the character of the rock which it penetrates. In this well the average wear has been 110 feet, though in one passage of 137 feet, through almost pure quartz, it had to be withdrawn and renewed for every 8 feet passed through. In sandstone the same drill would have endured through about 900 feet.

The core which has been taken from the drill shows the strata of the island; thus far it has been principally of granite and gneiss, with the stratum of quartz referred to. At its present depth the rock is more broken and pebbly, and recently several narrow veins of sandstone have been encountered, so that the immediate prospect seems encouraging.

"There is water down there somewhere," said the engineer in charge, "and we intend to keep on down until we reach it, no matter how far we must continue." He then referred to a well in Chicago in which the boring had been continued more than 2,000 feet, and the result had been gratifying.

A Large Block of Sandstone.

At the Dark Hollow stone quarry, near Bedford, O., one of the largest stones ever blasted in this country was "lifted" a week or two ago. The stone is 40 by 50 feet square and about 30 feet thick, and it required 185 slip wedges to make a successful blast. When cut up into pieces it will make nearly 300 car loads of building stone. Immense blocks of stone are frequently taken out of the quarries here which would make the stones in Solomon's Temple mere pebbles in comparison. Its weight was estimated to be about 6,000,000 pounds.

Petroleum for Coughs.

Dr. Moubré, writing to the *Gazette des Hopitaux*, gives his experience of petroleum capsules in simple and chronic bronchitis. This balsamic had been brought before the Therapeutic Society by Dr. Blache a year ago, at the suggestion of a Paris chemist, who named it Gabian oil, in order to prevent public prejudice. Each capsule contains 25 centigrammes of pure petroleum, the ordinary oil not being used, as it has to be distilled in contact with sulphuric acid to render it fit for lighting purposes. At the Hopital Beaujon, where these capsules have been freely ordered for chronic bronchitis, a rapid diminution of the secretion and fits of coughing were observed. In tuberculosis this medicine gave encouraging results.

AMERICAN INDUSTRIES, No. 40.

OLEOMARGARINE—HOW IT IS MADE.

The wholesomeness of beef fat as an article of food has never been questioned. It is always and unavoidably eaten with beef, however cooked; for the leanest meat not only has more or less fat mechanically attached to it, but also inseparably mixed with the muscular fibers. To insure a liberal incorporation of fat with the lean, our beef is, in one sense, always over-fattened. While the lean flesh is receiving the desired admixture of interstitial fat, the animal is overcharged with it, storing up in various parts of its organism masses of clear fat largely in excess of the amount needed for cooking purposes. Until recently this extra fat has been lost to the food supply, being converted by rude processes into inedible though not necessarily unwholesome tallow, to be used in soap making, candle making, for lubricants, and so on.

About a dozen years ago M. Mége, a French chemist, commissioned by his government to investigate certain questions of domestic economy, was led to make a special study of beef fat to see whether a larger portion of it might not be preserved for dietetic uses. The horned cattle of France exceeded twelve millions in number, some millions of them being sent every year to the shambles; and it was obvious that if each were made to yield even a few pounds more of edible fat an enormous and valuable addition would be made to the national food supply. M. Mége began with a comparative study of beef fat and butter. The essential part of the latter, its oil, differs from the oil of suet in containing a percentage of butyric compounds which give to butter a part of its flavor, and is lacking the large proportion of stearine which gives to suet its hardness and rough grain.

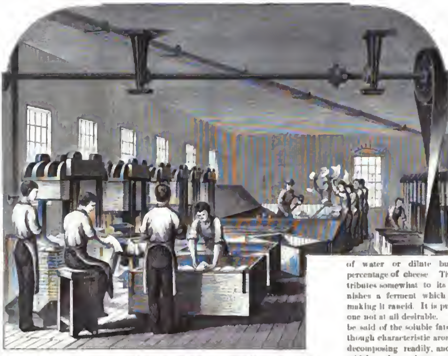


Fig. 5.—PORTION OF PRESS ROOM.

While investigating the origin of butter in the animal economy, M. Mége found that cows, when deprived of food containing fat, still continued to give milk yielding cream. The only possible source of the fat thus exhibited was the stored-up fat of the cow's body. Hence, beef fat could be converted into butter-fat. But how? Physiology taught that the change was wrought in the living organism through the withdrawal of the larger part of the stearine by respiratory combustion; the secretion of the remaining oleomargarine by the milk glands, and its conversion into butyric oleomargarine in the udder under the influence of mammary pepsin.

In the process of making butter by the ordinary method, during the process of churning the cream, the finely divided butter-fat is united in masses containing, by mechanical admixture, from twelve to fourteen per cent of water or dilute buttermilk carrying a fractional percentage of cheese. The latter ingredient of butter contributes somewhat to its flavor, and at the same time furnishes a ferment which ultimately spoils the butter by making it rancid. It is purely an accidental ingredient, and one not at all desirable. And to some extent the same may be said of the soluble fats, which give to butter its variable though characteristic aroma. They are unstable compounds, decomposing readily, and furnishing the acrid products which make so large a portion of the butter of the shops more or less unsavory and unwholesome.

To solve the practical problem set him by the French authorities, namely, to convert the surplus fat of beeves into a savory food product, M. Mége sought to imitate the processes of natural butter making, that is: (1) To separate

Fig. 9.—PACKING IN FIRKINS.

Fig. 7.—ICE ELEVATOR.

Fig. 8.—PACKING FOR THE RETAIL MARKET.

THE MANUFACTURE OF OLEOMARGARINE IN NEW YORK.—Fig. 6.—GENERAL DELIVERY ROOM.

from the oily fat of suet the cellular tissue and excess of stearine; (2) to add to the oil a sufficient proportion of butyric compounds to give the necessary flavor; (3) to consolidate the butter-fat without grain, and to add, at the same time, the requisite proportion of water, salt, and coloring matter to make a compound substantially the same in composition, flavor, and appearance as butter churned from cream; all this without adding to the original fat anything dietetically objectionable, and without subjecting it to any process capable of impairing its wholesomeness.

The method developed by him in this commendable undertaking can best be appreciated by following it step by step through the extensive works of the Commercial Manufacturing Company of this city, at West 48th street, North River, where it is practiced on a large scale, with such improvements as experience has proved to be advantageous. Our artists' abundant illustrations will make any elaborate description of the several operations quite unnecessary.

At an early hour each morning the selected fat from the several abattoirs about the city begins to come in. The fat being received within a few hours from the time of killing, it is and must necessarily be fresh. After being weighed the fat is thrown piece by piece into large vats of tepid water; any pieces showing blood stains being thrown into a special vat for extra washing. After soaking for an hour in the tepid water, the fat is thoroughly washed with cold water and then covered with fresh cold water and left another hour to soak. It is then assorted. The pieces rich in oil are severed from the rest by a skillful cut, the assorter throwing the finer pieces into an adjoining tank for another washing, and the pieces less rich in oil into tubs to be transferred to the tallow factory. The fat for butter making is now carefully washed a third time, then elevated to the floor above for hashing and melting. The object of hashing is to disintegrate the fat, thoroughly breaking up the tissues so that the oil will separate therefrom at a low temperature. This is necessary to prevent the development of the rank tallowy flavor which results from the action of a heat, such as was heretofore used for the melting of tallow before the Mége discovery.

The hashing machine is simply a series of knife blades revolving in an iron cylinder; the fat being fed in at one end, and, after disintegration, forced out at the other end through a perforated iron plate. From the hashers the fat is conveyed to the melting tanks, a series of caldrons, jacketed and surrounded with water. The water is heated by steam, and in turn heats the fat, which is melted at a temperature of from 122° to 124° Fah. When the fat is thoroughly melted the mechanical stirring is suspended, the particles of membrane settle to the bottom, forming "scrap," and a thin film of white emulsion of water and oil forms on the top. The latter is removed and the clear yellow oil is drawn off into wooden tank cars, which are sent into the "seeding" or press room to rest while the oil is granulating by the crystallization of the stearine. The melting process occupies from two to three hours, and the granulation fully twelve times as long, the temperature of the room being kept at 85° Fah.

The refined fat is next pressed, when the excess of crystallized stearine is removed by straining under pressure. The fat is now packed in cloths set in moulds (as shown in the foreground of Fig. 5) to form packages about the size of a common brick, the packages being placed on galvanized iron plates in the presses on the left. When a press is entirely filled the packages are subjected to a slowly increasing pressure, under which the fluid oil flows out until the stearine cakes are left dry and hard, when they are removed by an adroit flirt of the canvass wrapper, as shown in farther corner of the press room. The larger area of this room is occupied by cans of crystallizing fat.

Two important steps in the butter making process have thus been completed. The thoroughly washed suet has been deprived, first, of the inclosing cellular tissues, and next, of the excess of stearine. We have now a limpid amber-colored oil, perfectly sweet, and substantially the same as the oil of butter. When cooled this oil, or oleomargarine, is slightly yellow in tint, melts in the mouth like butter, and has an agreeable taste. At this stage it furnishes an excellent fat for culinary purposes, and may be kept for a long time without risk of becoming rancid. This makes it much preferable to ordinary butter for naval uses. In the works of the Commercial Manufacturing Company, the larger part of the butter oil formerly did not go beyond this stage, being drawn off from the press room into casks for exportation. At present the company cannot supply the demand for butter.

To convert the butter oil into butter, it is necessary for it to undergo the processes by which fat is converted first into cream and then into butter, in the udder of the cow and in the churn. For this purpose so much of the daily product of the Manufacturing Company as is needed for home consumption is forced through pipes to the churning room. In the cow's udder the fat which is to be converted into cream is divided into minute globules, in other words, emulsionized by the action of the mammary pepsin in the milk. To accomplish the same end in the factory the butter oil is churned with milk for about twenty minutes, when the oil is entirely and minutely broken up. At the same time a small quantity of the solution of annatto is added, as is commonly done in ordinary butter making, to heighten the color of the product. The churning ended, the mixture is withdrawn from the churn into a tub of pounded ice, as shown in Fig. 3. The sudden cooling causes the emulsionized oil to solidify without crystallization. After remaining for two or three hours in contact with the ice, the butter-like oil is worked over by hand and the pieces of ice removed. The product has now the appearance of freshly churned butter, but it is deficient in the soluble butyric elements which give to creamery butter its delightful odor and flavor, and, it must be added, its tendency to become rancid with age. To supply these essential elements of savory table-butter the product is churned a second time with nearly an equal weight of milk, during which process it takes up a sufficient quantity of milk to make it to all intents and purposes the same as dairy butter; not so delightfully fragrant, it is true, as the finer grades of creamery butter, but much more attractive to the senses of taste and smell than the average butter of the shops.

After the second churning the butter undergoes substantially the same operations of working over to press out the excess of milk, salting, packing, etc., as are practiced in our dairies; in these, as in the preceding operations, scrupulous cleanliness being a characteristic feature.

The works of the Commercial Manufacturing Company are three stories high, and cover an area of 22 city lots—about 1½ acres. Our illustrations give some idea of the magnitude of the operations carried on in them. From an average of 100,000 pounds of fresh caul fat received daily, from 40,000 to 50,000 pounds of butter are produced—equivalent to the yield of nearly as many thousand milch cows. From 20 to 25 pounds of beef oil suitable for butter making is obtainable from each of the 12,000 beeves killed every week for the requirements of New York and the adjoining cities—an annual addition to the food supply of this port of not less than 12,000,000 pounds of pure food, having a dietetic as well as a commercial value of from 15 to 20 cents a pound. The possible annual gain to the whole country from Mr. Mége's discovery runs high among the millions.

For those who are curious to know the comparative compositions of natural and artificial butter, the following analyses are appended. It is proper to add that owing to differences in cattle, in their food, and in the common processes of butter-making, natural butter is somewhat variable in composition. The figures given below, however, may be taken as a fair average.

ANALYSIS OF NATURAL AND OLEOMARGARINE BUTTER, BY DR. H. A. MOTT.

Constituents		No. 1. Natural Butter.	No. 2. Oleomargarine Co. Butter.
Water		11·968	11·203
Butter solids		88·032	88·797
		100·000	100·000
Insol. fats	Olein	23·824	24·866
	Palmitin		
	Stearin	51·422	56·29
	[illegible]		
	[illegible]		
Sol. fats	[illegible]		
	[illegible]	7·432	1·823
	Caproin		
	Caprylin		
Casein		·192	·621
Salt		5·162	5·162
Coloring matter		Trace.	Trace.
		88·032	88·797

The low percentage of the bracketed compounds in artificial butter may be regarded both as a defect and as a merit, inasmuch as they give to natural butter much of its savor and fragrance, and at the same time furnish the elements of its speedy spoiling. Lacking them, oleomargarine butter does not easily become rancid, and is, therefore, pleasanter and more wholesome when long kept.

Considerable misapprehension exists as yet in the public mind regarding the merits of this article as a food product, owing doubtless to its being comparatively new and to the misrepresentations which have been made regarding it. That there are two sides to this, as with most other questions, is evident; thus far only the interests of dairymen have been heard of. Producers of butter urge that oleomargarine injures their profits by preventing high prices for butter. If this be so, it argues good to consumers, whose interests must also be considered.

Another important benefit to consumers is that oleomargarine chiefly interferes with the sale of common grades of butter, to which it is far superior, and it is mainly dealers in this grade of butter who raise an outcry against the new product; although this outcry has been taken advantage of by parties outside of the dairy interest to curry favor with dairymen and serve their own selfish ends.

The complaints of farmers against oleomargarine are unfounded in fact and are kept up only by appeals to unthinking prejudice. Oleomargarine is as much a farm product as beef or butter, and is as wholesome as either. It is as legitimate a commercial product as tallow or lard, which might be as well proscribed as oleomargarine.

The only argument advanced by its opponents which has any validity is that it is sometimes sold as butter; this practice, however, has been greatly exaggerated; wholesale dealers sell it for what it is, and the number of retail dealers who do the same is daily increasing. It should of course be sold as oleomargarine, and the influence of the Commercial Manufacturing Company and of its sales agents, Messrs. Thurber & Co., has been steadily exerted to that end. Apparently some of those who are loudest in their outcry against oleomargarine cannot comprehend that it is better to have it handled openly and above board by such firms, than by irresponsible and unscrupulous parties who might adopt the opposite course and encourage retail dealers to sell it as butter. Oleomargarine is a *fact* in the commercial world and must be treated as such.

RECENT INVENTIONS.

Mr. Charles H. Dederer, of Jersey City, N. J., has patented an improvement in the manufacture of horn buttons. The object of this invention is to utilize a portion of the horn not heretofore used for buttons, to render the buttons more ornamental, to manufacture large horn buttons, and to produce them cheaply.

An improvement in plows, patented by Mr. George Watt, of Richmond, Va., relates to the manner of attaching to the standard of a plow the point and share, the mould board (which may be in two detachable parts), and the sole or wearing piece of the land side. The attachment is effected by means of two bolts and by projections or knobs and hooks, or equivalent devices, which are cast solid with or riveted to the several parts.

An improvement in endless chain horse powers, patented by Mr. Harrison Y. Krauss, of Kraussdale, Pa. It consists in the combination, with the shaft that carries the sprocket wheels and the shaft that carries the belt wheel, of a set of gearing constructed to run the belt wheel in either direction.

Mr. John Baughman, of Indianapolis, Ind., has devised an improved belt tightener for drawing the ends of belts together for lacing or riveting. The invention consists in connecting a tightener with the belt by wedge-shaped cross bars, so that the tightener may be separated from belt by the blow of a hammer, and all screws, stirrups, etc., dispensed with.

Mr. Josephus Craft, of Worthington, Minn., has patented a compound for preserving fresh fruit, composed of bisulphite of calcium and biborate of sodium dissolved in glycerine and sirup.

Mr. Aaron B. Hartman, of Onawa, Iowa, has patented an improved iron fence post which may be made of such materials as may be obtained in nearly every section of the country, and requires no transportation of waste material.

An improved end gate for wagons has been patented by Mr. Jesse S. Howey, of Lexington, Mich. The object of this invention is to facilitate the removal of the end board or gates and coupling rods of wagons.

An improved belt fastener, which is simple in construction and convenient and reliable, has been patented by Hoffman G. Redsecker and John T. Redsecker, of Athens, Ill. The invention consists in a belt fastener, having a curved plate, provided at its opposite ends with internally beveled loops and grooves, in combination with toothed fastening bars.

Machine and hand taps to be used in cutting internal or female screw threads, has been patented by Mr. William Kenworthy, of Brooklyn, N.Y. It consists in a tap having two or more threaded sections, separated by clearance spaces, or spaces without threads, the object being to facilitate the escape of chips from the tap and from the threads being cut.

An improvement in traction engines or road steamers, intended to draw loads on ordinary roads, and to be used for thrashing, corn shelling, wood sawing, and kindred purposes, has been patented by Mr. Oliver H. Burdett, of New Athens, O. The object of the invention is to squeeze the dirt between diagonal bars, and leave the face or outside of the wheels clean; also, to give elasticity to the axle frame; also, to hold the boiler securely in place on the engine, and to secure the steam cylinder to the under side of the boiler.

Mr. Henry C. Bowen, of New York City, has patented a method of determining the temperature of gas retorts and progress of distillation within the same, so as to enable the operator to control the decomposition and secure greater uniformity in the quality of the gas. It consists in recording upon a piece of paper or other equivalent material the richness of the gas in carbon by condensing upon the paper, from time to time, spots or surfaces caused by the impact of a jet of the crude gas, which evidence by their depth of color or proportion of carbon, the activity of decomposition, and correlatively the heat of the retort, so that the latter may be controlled in temperature to secure uniformity in the product.

MACADAMIZED roads were never intended for the metropolis and for large towns, and in such places we must hope that their days are numbered. For constant and heavy traffic combined with high speed, as it occurs in all important towns, a macadamized road becomes a nuisance, it requires everlasting repairs, and consequent stoppage of the traffic; it damages and wears out the better class of vehicles passing over it to an alarming extent; and is dirty, unwholesome, and unpleasant in all weathers.—(Inaugural Address of Joseph Bernays, delivered before the Society of Engineers.)

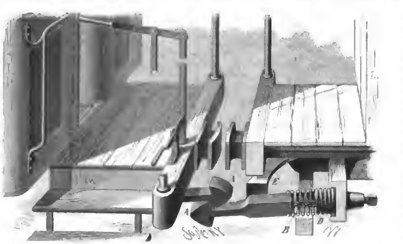
TRANSPLANTING THE TULIP TREE.—The *Rural New Yorker* states, from trials, that young tulip trees may be easily and safely removed by cutting back the entire stem within two or three inches of the neck, leaving only neck and roots to be set out. Hundreds of trees thus treated mostly grew vigorously, sending up from near the roots new and straight stems.

A FEW years ago Mr. Gideon Bantz, of Frederick, Md., invented what he terms a "fold skin leather," which he has manufactured successfully during the past five years. The chief advantages of Mr. Bantz's leather consists in its waterproof and enduring qualities, which render it specially useful for hunters, fishermen, coachmen, and others, whose occupation exposes them to the weather.

NEW CAR COUPLING.

The annexed engraving represents an improved car coupler recently patented by Mr. Alexander Peck, of Farmingdale, Ill. It is capable of automatically coupling cars of unequal heights, and is operative in such cases as commonly require a bent link, at the same time it is a safe and convenient coupler for cars of any kind. The couplers, A, are provided with arrow-shaped heads, whose interlocking faces are beveled, so that when coupled and drawing they cannot slip apart and become uncoupled so long as the cars keep the track. A chain, B, connects the coupler with the draw bar, and is surrounded by a spiral spring which holds the coupler in a horizontal position except when engaged by another coupler; it then yields sufficiently to admit of coupling two cars of the same height or of different heights within wide limits. Each coupler is provided with a lever arrangement, by which it may be raised to uncouple it or to bring it into the proper position to be engaged by the opposing coupling, when the cars being coupled happen to be of exactly the same height.

The inventor states that this coupling is safe and effective, and may be readily applied to ordinary cars without any material alteration and without the removal of their buffers. Its construction is such that should any of the cars leave the track they immediately become uncoupled and leave the rest of the train. The advantages of this coupling will be readily understood by persons familiar with the requirements of railroad engineers.



PECK'S CAR COUPLING.

AUTOMATIC HUB MORTISING MACHINE.

The annexed engraving represents an automatic double chisel hub mortising machine, manufactured by the Defiance Machine Works, Defiance, Ohio. This machine is automatic in all its movements, it will make stagger mortises as well as straight, and will mortise hubs from three and one half inches up to thirteen inches in diameter. It is adapted to a wide range of work, and is very strong and well built, and although the engraving makes it appear rather complicated it is in reality more simple than the ordinary single chisel machine.

The chisel bars in this machine are inclined at the proper angle, and are both driven by a single crank shaft. Their lower ends are run in slides so that all springing is avoided and the work is done with accuracy.

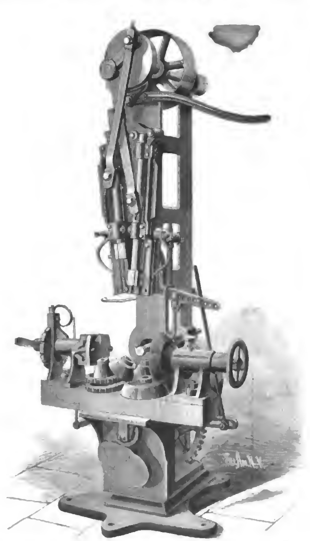
The hub is carried up to the chisels by a cam seen underneath the bed, and the auger which bores the hub previous to mortising is brought into action at right angles to the chisels.

The auger spindle will be seen in the engraving projecting through the standard just above the bed.

This machine is no experiment, it having been in practical operation for more than ten years, giving the best of satisfaction. It is capable of beating 7,000 $1\frac{1}{8} \times 2\frac{1}{2}$ mortises in ten hours without fatiguing the operator.

The manufacturers inform us that the double crank, chisel bars, auger-spindle, the pins, and the shafts are all made of steel. Everything about the machine is calculated for heavy and continuous work.

Further information may be obtained from the manufacturers, whose address is given above.



DOUBLE-CHISEL AUTOMATIC HUB MORTISING MACHINE.

Fire by Friction.

A company of South African savages, Zulus, are now amusing the people of London, at the Westminster Aquarium. Among other performances they show how they get fire without matches. Some straw being laid on the ground as a bed, two sticks were placed on it a few inches apart to form a support for the third stick, which was laid across them, having a deep notch cut in it to receive the blunt point of the drilling stick; this was twirled like a chocolate muller between the palms of the hands, and when the twirler's hands reached the bottom they were either dexterously shifted to the top again, or another of the Africans squatting round took on and relieved the first. A spark was got in the charred dust in about five minutes, and was received with shouts and leaps of delight by the fire makers, one of whom, carefully shielding it in a handful of the straw, soon fanned it into a flame.

MISCELLANEOUS INVENTIONS.

Mr. William H. Mintzer, of Colton, Cal., has patented a shoe for locomotive engineers, firemen, drivers of horse cars, and others, by the use of which they will avoid the pain and diseases that they are subject to because of the jarring of the cars.

Mr. John M. Ludwig, of Edenburg, Va., has patented an improvement in the class of middlings purifiers in which the middlings are delivered upon a horizontal reciprocating screen. This is a simple and economical middlings purifier by which a large percentage of a high grade family flour may be obtained. The machine occupies small space, and may be run with less power than an ordinary grain separator.

Mr. William E. Woodruff, Jr., of Little Rock, Ark., has patented a machine for printing addresses on newspapers, pamphlets, wrappers, envelopes, etc., from movable, consecutive, and connected forms or printing surfaces.

Mr. Thomas Soden, of New York city, has lately patented a novel bed lounge. The improvements relate to the arrangements for transforming the lounge into a bed.

A novel game apparatus, patented by Mr. William B. Cowan, of Guelph, Ontario, Canada, relates to games for parlor amusement; and it consists in combining with outside walls and wings, other walls with end wings, and an armed extension inclosing a space opposite a V-shaped projection. This invention cannot be clearly described without engravings.

An improved stock car has recently been patented by Mr. John L. Copp, of Rochester, N. H. The object of this invention is to furnish stock cars so constructed that the stock can be conveniently fed and watered without being removed from the car.

Mr. William Freeland, of Brooklyn, N. Y., has patented a simple, durable, and safe device for securing carriage traces to the whiffletree, especially adapted to light harness having slotted leather traces, and it consists in a slotted pin fitted with a spring blocking piece, which is normally projected by the spring to retain the trace, and when depressed closes within the pin and flush with its surface.

Messrs. Joseph W. Cole and Columbus M. Cole, of Warren county, Ky., have patented an improvement in the class of machines for extracting honey from the comb by the effect of centrifugal action. The inventors of this machine have aimed at the greatest simplicity, and have provided for the convenient insertion and removal of the comb, for supporting comb of any size without the aid of a supplemental device, and for reception of the extracted honey into cups or buckets, which are made detachable for the purpose of enabling them to be removed when filled and replaced by empty ones.

Mr. Enoch B. Norton, of Hartford, N. Y., has invented an apparatus for sprinkling Paris green liquid on plants attacked by insects, the object whereof is to enable the liquid to be carried conveniently in a suitable vessel, and to permit the quantity of liquid delivered and the direction in which it is sprinkled to be promptly regulated by the operator.

An improved rocking chair, which is so constructed that it may be adjusted for use as a reclining chair, and may be compactly folded for storage and transportation, has been patented by Mr. Chauncey D. Hyde, of Pitcher, N. Y.

Mr. Cyrus Norwood, of Winters, Cal., has patented an improved electric or galvanic belt to be worn upon the person for the purpose of allaying pain and preventing and curing various forms of disease.

Mr. Jordan H. Mitchell, of Eufaula, Ala., has patented an improved buckle for connecting the ends of bale ties or bands; and the object of the invention is to furnish a buckle which shall hold the tie securely and can be used without the necessity of perforating or cutting the tie or band.

An improved end gate for wagons has been patented by Mr. George Jontz, of Wyanet, Ill. The object of this invention is to furnish end boards and top boxes for wagon bodies so constructed that the end board may be adjusted for use as a shoveling board and a dumping board.

Mr. Richard Young, of Brooklyn, N. Y., has invented a tool for ornamenting and finishing the surface of leather, which consists in a creaser or marker, such as is used for lining, and a roller for embossing and printing, the creaser being stationary, while the roller is fitted to revolve, so that in use a line or crease and a printed impression are produced at the same time. The tool is used in connection with a drum, hand jigger, or other machine of usual character for finishing leather.

An improved saddletree fork has recently been patented by Mr. Gustav A. Mittendorf, of New Braunfels, Texas. The object of the invention is to strengthen the iron fork by means of a bent wooden part.

Mr. Joseph Kintz, of West Meriden, Conn., has patented an improved drop handle for drawers, etc. The object of the invention is to prevent the knob from swinging in any but a vertical plane to and from the drawer, and the lapped portion from straightening out.

A lamp base, made of glass or porcelain, provided with two rings adapted to fit on the body of the base, and having two handles, each of which is attached to both of the rings, has been patented by Mr. Joseph Kintz, of West Meriden, Conn.

Mr. George W. Bolton, of Fredericksburg, Iowa, has patented a milk can provided with simple and efficient devices for cooling and gauging the milk and for removing the cream.

A NEW WRITING INSTRUMENT.

No one using an ordinary pen constantly, or even for any considerable portion of the time, can fail to feel the want of something better adapted to ordinary writing than steel or gold pens. The constant dipping, which not only takes time, but is fatiguing; the liability to blotting, and in the case of steel pens, their failure soon after they get into good condition for use, are all serious objections which existed from the first days of pens and ink until the invention of the complete little instrument shown in the annexed engravings. Fig. 1 shows the MacKinnon fountain pen in actual use; Fig. 2 is a sectional view showing the internal construction; and Fig. 3 shows the pen about to be closed to be carried in the pocket or laid upon the desk. In general outline it resembles many of the penholders or pencils now in use. The handle is a tube which holds ordinary writing or copying ink. The writing point is conical and terminates in a graceful tube of gold, tipped with iridium, polished smooth as glass. Through a fine aperture drilled through the iridium on the point, the ink flows at the slightest touch on any surface, and it is so constructed that as soon as the pressure of writing is removed, the ink instantly ceases to flow.

Fig. 3.—THE MACKINNON PEN.

Fig. 2.—SECTIONAL VIEW OF THE MACKINNON PEN.

1. Reversible Point Cover on Air Cap.—2. Walls of Ink Tube.—3. Ink Tube.—4. Air Chamber.—5. Air Vent.—6. Ink Joint. 7 and 8. Valve and Swivel Needle. 9. Diamond Writing Point.—The Point Section includes the whole Section from 6 to 9.

With one filling this pen is capable of writing from seventy to eighty pages of foolscap. It can never blot, and when not in use it is closed perfectly tight, so that the ink cannot thicken or dry. Any good ink may be used, and the ink reservoir is readily filled by means of a small glass filler accompanying each pen. The MacKinnon pen is not only of the greatest service to those who write continuously, but it is a very necessary article for canvassers and others who desire to make a permanent record, and to whom it is a serious inconvenience to carry the ordinary writing materials.

THE MACKINNON PEN OR FLUID PENCIL.

This pen has several advantages over its competitors, the most important of which are: The improved valve, which is operated by a weight instead of spring, making its action more reliable and rendering it less likely to get out of order. The writing point is a circle of iridium, one of the hardest of substances known, and is perforated with a fine tapering hole, through which the ink flows in writing. The patent for perforating iridium is controlled by the MacKinnon Pen Company, 2?0 Broadway, New York, and is applied exclusively to their make of pens.

These pens have been in use in the SCIENTIFIC AMERICAN office for over a year, and have given good satisfaction.

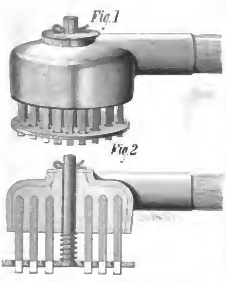
NEW STEAK-TENDERING MALLET.

The engraving represents an implement that will be appreciated by our readers, all of whom, without doubt, are lovers of wholesome and nutritious food. The palatableness of food lies not altogether in the cooking although cooking is often justly blamed for a poor dish. This is especially true of steaks. Good cookery can never make a tough steak tender, but it is possible, by the proper treatment, to prepare a steak of medium quality so that it may be served up as tender and juicy as the best cuts. This cannot be done by pounding it with rough or serrated hammers, but it may be accomplished by making innumerable incisions with a sharp instrument, which will sever the fibers without affecting the general appearance of the steak. Such an instrument is shown in the engraving, Fig. 1 being a perspective view, and Fig. 2 a central section showing the details of construction.

Thirty-six chisel edged steel teeth or knives are inserted in the head, and a perforated plate sliding on the knives and forced outward by a spiral spring serves as a cleaner, preventing the meat from adhering to the knives as the blow is given.

A steak treated with this instrument is rendered very tender and may be quickly cooked. A round or a shoulder may be made as tender as a porterhouse steak. It is stated that its effect on a veal cutlet is remarkable. We understand that this useful invention is meeting with a large and increasing sale.

Further information may be obtained by addressing the patentee, Mr. C. T. Stephens, Ithaca, N. Y.



STEPHENS' STEAK-TENDERING MALLET

MECHANICAL INVENTIONS.

An improved spoke tenoning machine, patented by Mr. Tarrence Connor, of Leavenworth, Ind., is adapted for attachment to the spokes, and fitted with cutting devices for reducing the ends of the spokes to the required size for entering the mortises of the fellies. It is simple, light, and convenient.

Mr. Joshua W. Jones, of Harrisburg, Pa., has patented improved attachments for hydraulic presses, so constructed as to close the outlet valve automatically when the follower has been run back to a fixed point, and to sound an alarm when the desired pressure has been attained.

An improved harness pipe loop attachment for wax thread sewing machines, has been patented by Mr. David M. Lewis, of Memphis, Tenn. The sewing of pipe loops by hand is slow and tedious work, and greatly increases the cost of the harness; but with this attachment it is said that such work will cost less and be stronger. It can be used on lower grades of harness, and will improve their looks and increase their market value.

An improved feed and gig mechanism for the carriage of circular saw mills has been patented by Mr. James H. Watson, of Tawas City, Mich. The invention consists in a combination of mechanism which cannot be clearly described without engravings.

An apparatus for illustrating the rules of perspective drawing, so that a teacher by its use can prove to his pupils the correctness of the diagrams made in accordance with the rules, has been patented by Mr. Frank O'Ryan, of New York city.

Mr. Isaac D. Beach, Jr., of Millersville, Mo., has lately patented a simple and efficient device for securing nuts upon bolts so that they cannot be jarred or shaken off.

Messrs. John Henderson, Jeremiah H. Henderson, and Justin Notson, of Leon, Iowa, have patented a churn by means of which large and small quantities of butter can be produced, as may be desired, and which is easily operated and is simple in its parts. It consists of the arrangement of two dashers, which are operated by means of two disks provided with pins that take in the slotted shafts of the dashers, these disks being fastened to the end of a horizontal shaft, which is rotated by means of a crank and bevel gearing.

Mr. Angus McKellar, of Fort Douglas, Utah Ter., has patented a simple device for drawing up the metallic skeins on an axle and holding them tightly in place as they become loose from the shrinkage of the wooden axle.

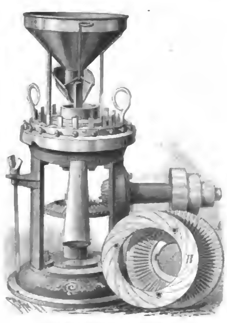
NEW OATMEAL MACHINE.

The mill shown in the annexed engraving is designed for granulating or cutting grain, such as oats, wheat, or barley. It is the invention of Mr. William Eberhard, of Akron, O., and is the outcome of practical experience in oatmeal milling. It is simple and efficient, and is giving good satisfaction where it has been introduced. The oats, which are fed in through the hopper, are carried outward by centrifugal force in the grooves in the rotating plate shown in detail at A, and are brought against a series of stationary knives arranged around the edge of the rotating disk. The outward motion of the grain is insured mainly by the radial grooves in the plate, A, but any tendency to clog is prevented by a series of spiral grooves in the cap, shown in detail at B.

The knives can be removed from the machine while it is in motion. The plates which carry the grain are made of chilled iron nicely polished. The machine is capable of being adjusted to different kinds of grain by changing these plates, three sizes of which are furnished with each machine. The inventor informs us that an eight inch plate machine will cut from twenty to thirty barrels of meal per day.

This machine is built on correct principles and seems very simple and practical.

Further information will be furnished by the inventor, who may be addressed as above.



EBERHARD'S OATMEAL MACHINE

BOILER PLATE TESTING MACHINE.

The engraving represents a testing machine recently built by Messrs. E. & T. Fairbanks & Co. for the United States Government, and placed in the office of the U. S. Steamboat Inspectors in the Post Office building in New York city. It is designed for testing the tensile strength of boiler iron, and has a capacity of 75,000 lb.

The weighing apparatus is a regular platform scale, and may be tested with standard weights to prove its accuracy the same as the ordinary platform scale. The strain is applied to the specimen of boiler plate by means of two screws and worm gears worked by a large gear wheel and a small pinion. By this arrangement of gears a man can easily apply 75,000 lb. strain with one hand.

The main beam, A, of the scale carries a poise or weight, B, which moves on rollers and may be run out to 75,000 lb. The light beam, C, has a finer graduation on it running up to 6,000 lb. The poise, D, on this beam, is moved automatically by an arrangement of clockwork, E, attached to the end of the beam.

The platform of the scale, K, rests on four knife edges in the main levers, F, one at each corner of the scale. These levers connect with the double lever, G, through which the strain is transmitted to the lever, H, and then through the lever, J, to the steelyard rod of the scale and by that to the beam, A.

The two columns, L L, with the cross-head and upper clamp, M, rest on the platform of the scale. The lower clamp, N, is secured to the cross-head, P, which is worked up or down by the two screws, R R, turned by worm gears S S, on their lower ends, which receive their motion from worms on the shaft carrying the gear wheel, T.

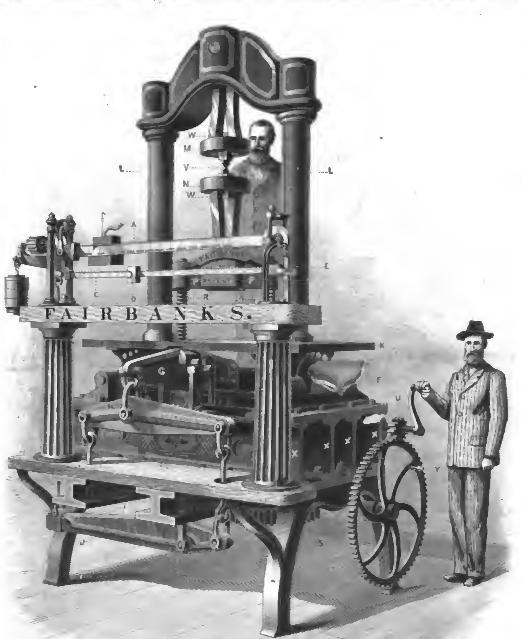
To make a test, the specimen, V, of iron to be tested is secured in the clamps, M N, by steel wedges, W W. When this is done the specimen is the only connection between the screws and gearing and the platform of the scale.

To begin the test the pinion, U, is shipped out of gear, and the gearing and screws are turned by the handle, Y, until a slight strain is applied to the specimen, when the pinion, U, is shipped into gear. As the strain on the specimen increases the beam of the scale rises, causing the automatic poise, D, to move along on the beam until it reaches the point equal to the strain applied to the specimen, when the beam drops and the poise instantly stops. This operation is continued until the specimen is broken, when the point at which the poise stands will indicate the exact number of pounds which were required to break the specimen.

We are informed that the Government has ordered two more of these machines, which are now on their way to Cincinnati and San Francisco.

This machine is believed to possess many advantages over other testing machines; its accuracy can be determined by actual test, the same as would be applied to any platform scale, and by the use of screws and worm gears, a steady strain can be applied and maintained for any length of time.

Machines on the same general principle as the one here represented, but changed in minor features to accommodate different test work, are also manufactured by Messrs. E. & T. Fairbanks & Co., whose office is at 311 Broadway, New York.



BOILER PLATE TESTING MACHINE.

Assyrian Vases.

The Museum of the Louvre, Paris, has just acquired two vases of large size, and of the utmost importance from the scientific point of view. They are two Etruscan vases of the earliest period, with paintings in white on a red ground. On one is seen a chariot attacked by a lion—a manifest imitation of Assyrian art—and a naval engagement between two very singularly shaped vessels. The other shows two lions rampant in the Asiatic style, and two Greek myths—the birth of Athena and the boar hunt of Calydon. It likewise bears an Etruscan inscription, one of the most ancient known. The representations of Hellenic fables had not been previously noticed on remains of Etruscan painted pottery of such early date, for the two vases may be confidently attributed to the eighth or the seventh century B.C.

The Bulwer Standard Mill.

This magnificent quartz mill consists of thirty stamps, and is built after the most approved plan. The ore will be run from the tunnel direct to the ore house, into two large bins, where it will be broken and screened, falling into the main body of the ore house that is connected with the batteries by automatic feeders, self-adjustable. These feeders are a model of mechanical ingenuity and well worth a visit. There are two distinct batteries of fifteen stamps, parallel with each other, working from pulleys on the same shaft placed on a center shaft between the batteries. The capacity of the batteries is about one hundred tons a day, depending on the character of the rock. The slum tanks are ranged on each side of the amalgamating room and are supplied with centrifugal pumps, and hose to charge the pans. The pulp is carried from the batteries to the slum tanks in sluice boxes, with openings over each tank to fill them, requiring but one man on each side to fill the tanks and charge the pans. The pans are set parallel with each line of slum tanks, and are furnished with a patent steam quicksilver pump. This pump saves handling of the quicksilver when cleaning up or charging the pans. Between the lines of pans is one open passageway, giving plenty of room for working purposes. The engine that drives this mass of machinery is a 225 horse power poppet valve, set in a parlor adjoining the amalgamating room. It works as smoothly and easily as a noiseless sewing machine, and is a splendid piece of mechanism, fitted up with the latest improvements, and handles the mill machinery with ease. The boiler room adjoining the engine room is large and spacious, with two sets of boilers, the steam drums as large as boilers for ordinary use. One of the boiler furnaces is built after the old style, the other set is fitted up with Box's patent fuel-saving furnace. It is claimed to save one eighth of the wood to do the same work as the old style of furnace. They are in use at the Justice mine, Gold Hill, and have been for the past eighteen months, and no doubt its competitor by its side will soon be replaced by the Box patent. The arrangement of this furnace, or its novelty in patent parlance, is the partition fire wall that extends close to the boilers, an arched opening being left on a level with the grate bars for draught, and extending back to an overhanging wall. The grate bars are set at an angle, and the coals from the furnace form a bed between the partition and the rear hanging wall; the draught carries the flames, gases, etc., over this bed of coals, a great heat being generated, igniting the gases and utilizing the heat for steam purposes; that with the old style of furnace passed away and up the smoke stack without igniting.

It strikes us as being a valuable invention, and one that must make a great saving in wood, and to mills or mines using large quantities this should be a material object. Bodie can now boast of one hundred and fourteen stamps in active operation, and in a few days ten more at the Spaulding mill will be started, when one hundred and twenty-four stamps will be crushing away day and night. This will more than double the former yield of bullion from Bodie.—*Bodie News.*

Dr. Auerbach, writing to the *Chemiker-Zeitung*, mentions as a curious fact that during an entire summer he observed water beetles—probably *Gyrinus natator*—living in tanks of a saturated solution of Glauber salt. When alarmed the beetles took shelter under the crystals, just as they do in ordinary circumstances under water plants. A little of the liquid so harmless to insects, having found its way by leakage into an adjoining river, proved fatal to multitudes of fish.

THE ELEPHANT CALF AND ITS MOTHER.

We present herewith a portrait of the elephant calf, whose birth in Philadelphia was noticed a few weeks ago. The event, from its rarity, has naturally awakened considerable scientific interest. It has afforded for the examination of our naturalists a full term placenta, and has also furnished evidence confirming the reports of trustworthy observers touching the period of gestation in the elephant (about twenty and a half months), the mode of suckling by the calf, etc. Contrary to newspaper reports the breeding of elephants in captivity is no novelty in itself; though from the limited number of elephants known in this country until within a few years, and the unfavorable conditions under which these few have been kept, it is not at all surprising that this birth should be the first on record here.

Heretofore the elephant has been classed as belonging to the pachydermata, but Professor Henry C. Chapman, Professor of Physiology in Jefferson Medical College, in a paper on the placenta of the mother, Hebe, is disposed to controvert this theory and classify it with the rodents. He grotesquely characterizes it as a "great big mouse." What are his grounds for this new classification remains to be seen on the publication of his paper, of which we have as yet only a meager report in the Philadelphia *Press*. The heart of the elephant is well known to resemble that of the rodent, and the bones to correspond with those of the human being, which the elephant resembles in other particulars.

The calf, of which we give an engraving, is, as previously noted, the offspring of two Ceylon elephants said to have been imported by Barnum in 1865. Mandrie, the father, is 26 years old and weighs about 8,000 lb. Hebe, the mother, is 23 years old and weighs 7,020 lb. From the time of their landing in this country they have shown a special attachment for each other. The female is noted for her uniform docility and gentleness, and the father for his beauty of form.

Mandrie and all the other elephants belonging to the circus seemed fully aware of the condition of the mother for months before her delivery; and afterwards both calf and father seemed to recognize the relationship existing between them, manifesting the same by various unmistakable signs.

The birth of the calf was the occasion of much excitement among the other members of the herd, whose trumpeting disturbed the lions and tigers in the adjoining house, causing them to roar in chorus.

Hebe became greatly alarmed, and, with a huge effort, parted both the great chains to which her hind feet were fastened to the stakes. The watchman fled for his life. On his return with several assistants they found Hebe rolling the little one over and over on the ground, and yelling violently.

Fearing that, in her excitement, she might kill her young one, the men endeavored to take it from her, but at that she seized it with her trunk, and tossed it across the ring, where it fell under a heavy railing surrounding a large stove. In an instant she had followed it. Finding the railing in her way she struck it down and tore it into splinters.

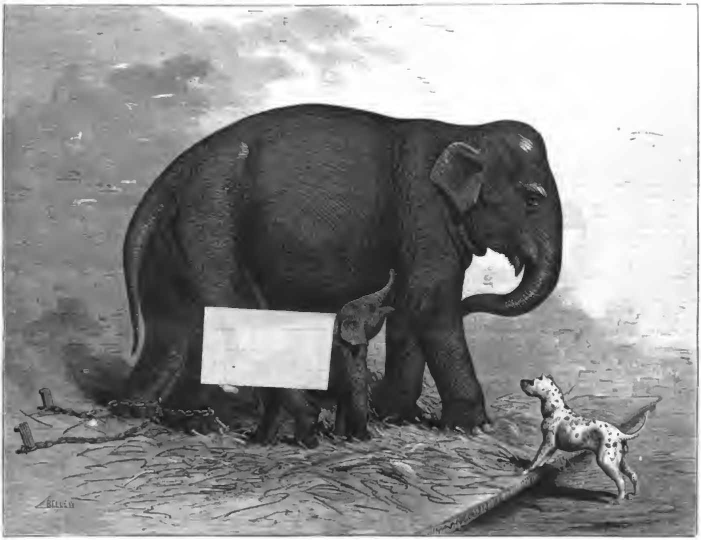
It is now believed that she had become alarmed by the roaring of the lions and tigers, and was trying to get it over to where the other elephants were chained and so secure their protection.

After a little time the keepers managed to calm the mother, and she allowed herself to be led back and rechained, but not for an instant would she permit the little one to go beyond the reach of her trunk. The calf was not at all injured by her rough usage.

For some time the mother continued so nervous and restless as to prevent the young one from suckling, in which dilemma the keeper hit on the device of constructing a kind of huge nursing bottle out of a yard of rubber tube and a funnel. One end of the tube was inserted into the mouth of the calf, while to the other end was attached the funnel, into which the mother was milked. The calf now suckles in the natural way, and not with the trunk as was supposed by Buffon and Aristotle. The udder, which is situated between the two fore legs, consists of two lobes with one teat each, like the breast of a woman. The teats project outwards, making them more accessible to the calf, which, as it sucks, presses the udder with its little trunk, while the mother slightly advances, and raises the leg on the side in use. Sometimes the mother will wind her trunk between the two fore legs towards her udder, either for the purpose of pressing it as women do with their breast, or in order to caress her calf. The little one suckles frequently, and seems to take great pleasure in walking under the mother's body, or in sprawling on its side among its parent's huge feet.

In appearance the calf is very like the mother, in shape, and color, and movement, but the eyes seem larger in proportion, and are rendered conspicuous by a line of pinkish hue round the lids. It has also a thin mat of black hair on the top of its head much resembling that on some human babies. It has, too, a decidedly infantile expression, remotely suggestive of a sucking pig.

When born it weighed 213½ lb. and stood 35 inches high. It has not been weighed recently, but is growing rapidly, as all elephants do for the first three or four years of their lives. In its intercourse with human beings it is disposed to be friendly and inquisitive, poking its little trunk into the pockets and up the sleeves of those whom the mother allows to approach it. The mother is, however, extremely jealous of strangers, and will not allow some old comrades and pets in the shape of a pair of coach dogs to come too near. The other elephants in the menagerie, being of her own kind, she regards as reliable friends, and seems only flattered by the caresses they bestow upon her little one.



THE ELEPHANT CALF AND ITS MOTHER.

Hybrid Fish.

At the meeting of the American Fish Cultural Association in this city, March 30, Mr. R. B. Roosevelt read a paper on hybrids, in which he said that, since the creation of the fish hatchery commission several attempts have been made to cross varieties of fish, and with success in the following varieties: Salmon trout with white fish; salmon trout with brook trout; brook trout with fresh water herring, with California salmon, and with the California mountain trout; shad with striped bass and with herring. Of these crosses there are the young, now in the hatching-house, of the salmon trout brook trout, brook trout California salmon, and brook trout California brook trout. It is observable of all hybrids that they are usually more shy and wild than either of their parents, and that in appearance they generally favor their larger parent. The cross between the brook trout and California salmon and the salmon trout and brook trout bid fair to be fine fish. Those now in the hatchery are eight inches long.

The cross of the shad and herring, though not made under the most favorable circumstances, has done well. The young have thriven, and have been caught in the rocky shallows of the Hudson. They probably are not migratory, and can be taken with rod and line. The cross between the shad and striped bass has not been heard from. As some of these were hatched in the autumn of 1876, and quite a large number in the succeeding year, it was hoped that some of them would have been taken, full grown, before this. The final outgrowth of this experiment is left entirely in the dark. There can be no doubt, however, of the cross being made.

It was hardly to be expected that so wonderful a discovery as the creation of a new species could be made without trouble, and we should rather be surprised at the success already achieved in hatching the young of the cross at all. The number of combinations possible is very large, and the pains and care expended in improving plants, vegetables, and land animals may yet succeed with fish.

The Eye Parasite—*Dracunculus loa*.

Doctor H. M. Bachelor, of the American Presbyterian Mission at Gaboon, on the West Coast of Africa, communicates to the *Medical Record* the following interesting account of the eye parasite known as *Dracunculus loa* and *Filaria loa*.

A native young man presented himself, complaining of a "sick eye." I examined the organ, says the doctor, and discovered a white worm coiled up. Its situation was on the iris, beneath the sclera; but it was not at all confined, being capable of moving about, and even obstructing vision when in front of the pupil. It was constantly in motion. The eye itself was bloodshot and inflamed, while the lachrymal discharge was profuse. I succeeded in extricating it in the following manner: Holding the eyelids firmly open, the point of the small blade of an eye knife was inserted between the sclera and iris, care being taken that one end of the worm was between the blade and sclera. The handle of the knife was then depressed so that the point would, in being carefully withdrawn, cause the end of the parasite to protrude through the opening in the sclera. This accomplished, it was easily seized and removed with a pair of ordinary dressing forceps.

The *Filaria loa* is, I think, quite rare, or at least is seldom taken out entire. If I am rightly informed, only one specimen has reached the United States; but the French are conversant with it. It *generally* selects the lower eyelid for its first appearance, though it is often found in the pinguia. If undisturbed it causes intense itching and stinging pain in the part occupied by it, which symptoms disappear in two or three days, caused, no doubt, by its death. It is not considered dangerous or even serious. The specimen sent to America by one of the missionaries here was not entire, having been torn in the operation of extraction. The one in my possession is, I think, complete.

The writer adds that he has the specimen in a fifteen per cent solution of alcohol, and will be glad to forward it for examination to any oculist who is sufficiently interested to study it thoroughly.

The Ajax.

The turret ship Ajax was successfully launched from Pembroke Dockyard in March last, in the presence of a vast number of spectators. She was commenced four years ago, and is one of the heaviest war ships in the world, carrying four 38-ton guns in her turrets, and two 6-inch guns on her superstructure decks. The total weight of the armor plates, including the armor to the turrets and thick protective deck plating, is about 2,418 tons. The armor plates in the turrets are 16 inches thick in wake of ports, and 14 inches elsewhere. This armor will be compound steel-faced armor, which has recently been found by experimental tests, by being fired at, to possess a very much more effectual resistance to shot and shell than the armor plates which have been used up to the present time. The Ajax will also have an armor shield, composed of armor plates 12 inches thick, situated in the chart house or conning tower, which is built in an elevated position at the fore end of the citadel, in a line with the bridge, communicating between fore and aft superstructure decks. This shield is to afford protection to the captain of the ship, who will conduct the whole working of the ship from this look-out, by means of telegraphs and voice tubes. He will also be able to steer the ship himself, by means of steam, although the steam steering engine itself is right away aft, below the armor deck. He will also give his commands to the captains of the turrets, and fire the guns by electric wires. In fact, nothing will be done in any part of the ship, when in action, except under the direct command of the captain in this tower. The Ajax was designed by the Council of Construction at the Admiralty.

Prison Labor.

About a year ago the New York State Assembly called upon the Superintendent of the State Prisons, Mr. Louis D. Pilsbury, to examine and report upon the contract system of prison labor. Mr. Pilsbury's report is in the main favorable to the system, his experience and study leading to the following conclusions, namely, that every prisoner who is able to do so should be required to labor, and that this labor, for moral as well as for economic reasons, should be productive; all systems of non-productive labor, merely for punishment, having been abandoned by civilized governments, because it is degrading and mischievous in its effects upon prisoners and unjust to the State. Such labor lies at the foundation of every successful system of reformation. Society has a right to demand it as a partial restitution for the depredations of criminals, and for the cost of their arrest, trial, and maintenance in prison.

That no system of prison labor which human ingenuity has yet been able to devise is free from objections; but that, so long as the people of this State demand that the prisons shall be self-sustaining, the present contract system is, in Mr. Pilsbury's opinion, to be preferred, because—

1. It produces the best financial results.

2. It does not interfere with outside mechanical industries any more than any other system of productive labor that has yet been devised.

3. It gives to the prisoners some knowledge of a handicraft and enforces habits of industry, without which they are almost sure to return to a criminal career, and with which they are enabled to, and in many instances do, lead honest and useful lives upon their discharge.

4. It is not injurious to health, as is shown by the small number of hospital patients in our State prisons, and by mortality lists that compare favorably with those of communities in general outside of the prisons. Our convicts generally leave prison in better mental and physical health than when received.

The cost of maintaining the prisons of this State for the last fiscal year was $20,374.15; in 1876 the cost was $605,040.53. It is not claimed that these results are due entirely to the contract system, but under any other system they would have been impossible. The charge that contract convict labor materially interferes with free labor has not been proved. Compared with the total productions of the country the products of the prisons are insignificant.

There are 23,524 convicts in all the prisons of the United States employed at productive skilled labor, who compete, according to the census of 1870, with 666,625 workmen (less than four per cent) employed at the same industries in the same States, and with 269,240 workmen (less than two per cent in the whole United States engaged in the same industries as are carried on at the prisons. The percentage would be still less if the increase in the number of mechanics and laborers since 1870 were known.

The complaint that prison labor contractors injure other manufacturers and laborers by underselling the market, Mr. Pilsbury thinks unfounded in fact. And the impression that the contract system interferes with the discipline of the prisons is also pronounced erroneous.

Some Facts about New Zealand.

Mr. G. W. Griffin, U. S. Consul to New Zealand, reports a notable increase in the manufacturing interests of the colony, and a growing trade with this country. He thinks the furniture made in New Zealand the most beautiful he has ever seen. It is made of the mottled kauri wood, and is artistically designed. New Zealand produces the finest wood in the world, and manufactures some of it. The chief imports from this country are hardware, edge tools, and agricultural implements; tobacco, canned fruits, and wooden ware, including wagons and carriages. The inhabitants have a partiality for American watches, but do not take to American whisky. The only article sent from New Zealand to this country is kauri gum, which is largely used in the manufacture of varnish. One firm, which ships direct to the United States, sends four or five times a year cargoes worth $100,000 each. The gum is very transparent; one can see through a block of it a foot in thickness. It has the appearance of amber, and is found about the roots of the kauri trees. The natives make very artistic figures of their gods with this gum, carving beads and busts of it larger than life.

Is there a Central Sun?

It is singular, remarks Mr. R. A. Proctor [illegible] the *Weekly Chronicle*, how strongly some errors [illegible] hold on men's minds. When Mädler announced his belief that Alcyone, the chief star of the Pleiades, is the central star of the universe, men's minds were attracted by the thought that the steller system, like the sol[illegible] system, revolves around a center. Yet astronomers knew perfectly well that the evidence on which Mädler based his theory was exceedingly feeble. Sir John Herschel also pointed out how unlikely it is that the center of the Milky Way, if such a center there really is, can lie so far away from the mean plane of the Milky Way as the Pleiades. I have shown since that the only piece of positive evidence advanced by Mädler, the drift of the stars of the constellation Taurus in one direction, is in reality no evidence at all, for the simple reason that a similar drift can be recognized in other regions of the steller heavens. I believe that no astronomer of repute would now venture to maintain the theory that Alcyone is the central sun of the stellar system, while scarce any (if any) would maintain that there probably is a central sun at all. Yet I find that not only is the belief still widely spread among the general public that Alcyone is the central sun, but that this theory excites far more interest than most of the real discoveries, interesting though they are, which have been made during the last half century. When I reached Indianapolis I found myself called on to decide, not whether the theory is true or not, but whether it is due to Bessel or Mädler. My statement that the origin of the theory was scarcely worth considering, since the theory itself was long since exploded, was received in solemn silence, as if my words were scarcely credited. And when I had endeavored, and I think succeeded, in showing good reasons for rejecting the theory, I could still feel that most of my audience would a good deal rather have seen the theory established than overthrown. Such is the dominion which error sometimes achieves over men's minds.

The Great Southern Comet.

A private letter from Mr. Gill, H. M. Astronomer at the Cape, furnishes some particulars of his observations of the great comet up to the evening of February 9. Table Mountain interfering at first with the view from the Royal Observatory, Mr. Gill proceeded to Seapoint, on the west side of the mountain, where, from the garden of Mr. H. Solomon, in which Sir Thomas Maclear observed Donati's comet in 1858, he sketched the position of the tail among the stars on several evenings before the nucleus had withdrawn sufficiently from the sun's place to be visible. The nucleus was first seen on February 8, and then only for a few minutes through cloud; Mr. Gill thought it might have been visible the preceding evening, but haze near the sea horizon rendered it very difficult to say where the tail ended. He describes it as "a very poor affair, a faint nebulous thing not at all worthy of so fine a tail." Attempts were made to fix its position at the Royal Observatory on February 9, but only a glimpse with an opera-glass through cloud was obtained. The nucleus was "a little N. and E. of Theta Sculptoris;" in a tracing accompanying the letter in question, however, the nucleus is shown a little *south* and east of the star, and midway between two stars, which from Gould's "Uranometria Argentina," appear to be Lacaille 6 and 34, so that the place referred to the epoch of the "Uranometria," 1875·0 would be in about right ascension 2' 20' with 37 50 south declination, which is far from the position given by the elements telegraphed from Rio de Janeiro (to which reference was made last week) whether the heliocentric motion be assumed direct or retrograde; probably the orbit has been vitiated in transmission. On February 6 the tail appears to have been traceable nearly to Canopus.—*Nature*.

A Pleasant Surprise.

"L. T. Edleblute, of Cincinnati, upon returning from Leadville, has found a bonanza awaiting him in the shape of an offer of $50,000 for the right to manufacture his patent metal vehicle hub. The hub is so constructed that the butts of the spokes rest on rubber, giving a large degree of elasticity, and at the same time preventing all rattling, rumbling, and tremblings. It can be readily taken apart for repairs."

In sending the above clipping from the Cincinnati *Commercial Advertiser* of March 14, Mr. Edleblute adds: "The above patent was secured through your agency, and thanks to your skillful management, for the claims are unusually strong. The final papers will issue inside of three weeks. I believe that my hub will surely prove quite a financial success. I am now entertaining an offer from a Pittsburg house that will exceed above amount. By your excellent services in my behalf you brought to me the exceedingly large offer, for had not my case been well conducted I would, no doubt, have had to wait some time for a customer."

The Artificial Diamond Process.

The announcement that Mr. Hannay's paper on the artificial formation of the diamond was to be read at the Royal Society, February 26, brought together a large number of Fellows and their friends. After the meeting a scrap of paper with the following lines penciled on it was picked up not far from where the treasurer of the Royal Society had been sitting:

"The crystallized carbon, as diamond known,
Manufactured can be, Mr. Hannay has shown.
From some hydrocarbon set hydrogen free
Near a nitrogen compound, that stable must be,
In the presence of metal—magnesium or sodium—
And the brilliant result is the jewelers' odium."

The Best Vehicle.

An anecdote is told of a physician who was called to a foreign family to prescribe for a case of incipient consumption. He gave them a prescription for pills, and wrote the direction: "One pill to be taken three times a day, in any convenient vehicle." The family looked in the dictionary to get at the meaning of the prescription. They got on well until they got to the word vehicle. They found "cart, wagon, carriage, buggy, wheelbarrow." After grave consideration they came to the conclusion that the doctor meant the patient should ride out, and while in the vehicle he should take the pill. He followed the advice to the letter, and in a few weeks the fresh air and exercise secured the advantage which otherwise might not have come.

Remedy for Hydrophobia.

M. Torres Coicedo, Minister from Salvador, has just made a gift, says *La Nature*, to the Zoological Garden of the Bois de Bologne, of two curious plants—the "guaco" and the "cedron"—which for a long time have been extolled in America as antidotes to snake bites and hydrophobia. The discovery of these plants was quite singular. Some Indians had observed that a bird of prey, which captures and feeds on snakes, sought out the vine of the guaco, ate its leaves, and plastered them over its plumage. They were thereupon led to utilize the therapeutic virtues of the plant, and by its use effected marvelous cures in cases of hydrophobia, snake bites, and marsh fevers. The discovery of the properties of both the guaco and cedron, however, had already been made by Dr. Saffray in a voyage made by him through New Granada in 1869.

An English manufacturer traveling in America for the purpose of inspecting various industrial establishments has recently written as follows: "I spent some hours yesterday at the Cleveland rolling mills. They have a wire mill attached for drawing nothing but Bessemer steel wire, of which they turn out 75 tons per day, and have one room with 1,000 small blocks, each man tending 32 blocks, whereas in England we consider a man that runs 8 blocks of steel is a wonder. So much for your country. I saw it with my own eyes, and was never more astonished."

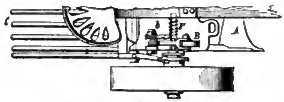
Eighty Miles an Hour.

The *National Car Builder* says that a locomotive on the Pennsylvania railroad made the fastest run on record a few evenings ago. It was ordered from the round-house to the scene of an accident, and ran 60 miles in 45 minutes and 8 seconds. This is at the rate of a trifle under 80 miles an hour, and is a very remarkable performance.

IMPROVEMENT IN POTATO DIGGERS.

The annexed engraving shows an improvement in potato diggers patented by Mr. James B. Taylor, of Leadville, Col., P. O. Box 2566 (formerly of West Hurley, N. Y.). The engraving shows only the portion of the machine that gives motion to the separating tines, C, and the shifting and adjusting mechanism. For a full perspective view the reader is referred to page 166 of the current volume of the SCIENTIFIC AMERICAN.

The plow, A, is suspended from a long bolt that extends across the rear of the machine frame, and is provided with a curved arm, which is jointed to a lever, B, pivoted to the main frame, and capable of engaging with a ratchet, *b*, so as to hold the plow at any desired elevation. A screen, C, consisting of a series of fingers projecting from a cross bar, is pivoted at one side of the machine, on the same bolt that sustains the plow, and is provided with an arm, D, carrying a roller that is engaged by a zigzag cam on the axle. This cam is movable on the axle, and is provided with lugs that may be thrown into or out of engagement with clutch teeth on the hub of the driving wheel by a shifting bar, F, which is always pressed by a spring tending to throw the cam out of engagement with the drive wheel. The shifting bar is provided with an inclined arm which is engaged by the lever, B, whenever it is thrown forward to depress the plow, thus throwing the cam into gear. It will thus be seen that by moving the lever, B, so as to throw the plow into position to operate, the shifting bar, F, throws the cam forward into engagement with the drive wheel. As the machine is drawn forward the plow, A, passes under the hills of potatoes, and both potatoes and earth are forced backward over the screen, C, which being vibrated by cam, E, separates the earth from the potatoes and delivers the latter in rows on the top of the ground.



TAYLOR'S IMPROVED POTATO DIGGER.

The Roller Suit.—The Patent Declared Invalid.

In the Circuit Court of the United States for the Eastern District of Missouri, September term, A. D. 1879: Robert L. Downton, plaintiff, *vs.* Yaeger Milling Company, defendant.—Patent.—W. G. Rainey and George Harding, Esqs., attorneys for plaintiff; G. M. Stewart and F. W. Cotzhausen, Esqs., attorneys for defendant.

Oral remarks of Treat, J., deciding cause:

I am prepared to announce my conclusion in the case of Downton *vs.* The Yaeger Milling Company. This case was presented at great length last spring, and it was announced to counsel at that time that if the court was compelled, as matters then stood, to decide the case, it would har cide it in a certain way, but it would be more satis if on certain points it could be more fully presented has been done, and very ably.

One of the points as to which the court was troub whether, under the existing state of the art—this process patent—there was any novelty in it. Secc the patent itself sufficiently specific in its terms to practicable, or, in other words, patentable, in the form pursued?

It is not proposed this morning to go through the milling literature with regard to these matters, as the various stages of all the matter involved were fully considered at the time of the hearing of the milling cases before Judges Dillon, Nelson, and myself. We were then very fully instructed as to this new process, and also as to the state of the art when the new process arose, and the conclusions announced in that case are very familiar to the counsel in this case, and to the milling public generally by this time.

Now, the mills using this new process interject rolls at various stages in connection with grinding, and after purifying, regrinding the purified middlings. Counsel were asked whether they construed this particular patent as covering *any* use of rolls on purified middlings at any stage of the successive grindings, or whether, under their construction of the patent, it was a use of rolls, one or more, at a stage intermediate the first and second grindings. Counsel were understood to say that the interjection of such rolls at any one of these successive stages was within the terms of the patent. The importance of that, if the testimony is understood, relates to the question of infringement.

There was a controversy at an early stage of this case growing out of the transactions between Downton, Allis & Co., of Milwaukee, and this defendant, Yaeger. Judge Dillon and myself disagreed in opinion with regard to the effect of the paper transactions involved; but his ruling with regard to the matter was necessarily the ruling in the case. He held that if there was an infringement of this patent then the defendant must answer except as to the two chilled iron rolls interposed between the first and second grindings, according to the terms of the patent; because Allis & Co., who were to some extent assignees in this matter, made those rolls according to Downton's description, Downton himself superintending the whole matter, and putting them in the mill. The contention being, on the part of Downton, that he informed these parties who had bought these rolls, which came under a subsequent patent, that while he put them in, they must give him a royalty under his process patent, and hence any use of the rolls by those parties did not exonerate them from a royalty therefor. Judge Dillon and I concurred as to those two; said they were supposed to have been put there for some purpose; they were put there by the plaintiff and under his very patent, and if it is said that they were put there merely to clog the machinery, and for nothing involving a purpose, such a proposition cannot be maintained.

Now, the court is brought, for the purposes of this case, to the construction of this patent. It has been read and reread very carefully. If there is anything in it that is patentable and involves novelty, it is not the use of rolls at every stage of this process, for all the Minnesota mills had been using it before, and in Europe and Missouri the same thing had been practiced for a long series of years. But it was the interjection of rolls between the first and second grindings, whereby certain effects would be produced—that is, such use flattens the germ or embryonic part of the berry, and also the pellicle, by a crushing instead of a grinding process. It is very obvious to any one who has looked into this subject, that if this grinding process is continued, whereby all the matter of the berry, including the germ—which seems to be the most obnoxious part of the whole—is mixed, then, instead of getting a first quality of flour, you have flour that is somewhat inferior in its character; for this waxy germ in itself has no especial nutritive property, but damages the flour through various causes. Hence, if you can take that out in the first instance, so that it shall not be ground into the body of the flour, it is certainly a most beneficial affect. To do it, you must crush, not grind, for this little embryonic particle is so very minute that unless you flatten it, it may, under trituration or grinding, pass into the middlings, and if you grind the middlings, it will go into the body of the flour. So that the true construction, and the only construction that will uphold this patent, is the interjection of those rolls between the first and second grinding of the purified middlings. By that means the fluffy matter would be thrown off, leaving the tailings to be operated upon thereafter. Then comes the next question, If that be the true reading of the patent, did this defendant use anything but the two chilled iron rolls at that stage of the process? The evidence is very uncertain on

mann patent, porcelain rolls no matter as to that. This urt asked particular atten- that by the use of rolls in certain beneficial results f the germ so that it will

"Now is that to be co... ...ed in this way: that any device that might at any time thereafter be had, whereby such a result may occur, is covered by this patent? It seems that anterior to this patent, Mowbray and others had been using rolls, and in that very stage of the process, but the contention was that the particular rolls that they were using did not effect the end to the desired extent; and hence subsequent to this process patent, it became necessary to have some rolls invented which would effect the end.

Now it is an elemental proposition as to patents that they shall be so clear that by ordinary means they can be worked out by a person skilled in the art. It is clear that this patent could not be operated by any method until some person invented rolls, which, while they should not be corrugated, because that would be as bad as the millstones in triturating, but should be smooth and yet have sufficient grip and be of sufficient hardness; and that was not all, they must have the same diameters and work with equal speed, instead of differential speed. Neither of which was suggested in the patent.

To summarize: The claim of the patent is specific. "The herein described process of manufacturing middlings flour by passing the middlings after their discharge from a purifier, through or between rolls, and subsequently bolting and grinding the same, for the purposes set forth." Those purposes, as the specification states, are mainly for flattening the germ. That object was effected by the interposition of rolls at that particular stage of the process. Rolls at other stages of the milling process had been previously used; and even rolls by Mowbray at that particular stage; hence if the patent is to be construed by its terms as covering the use of rolls at any stage of the milling process, it had been long anticipated prior thereto. If it is to be restricted to the use of rolls at the particular stage mentioned, then, so far as this case is concerned, the plaintiff is estopped, because he himself, as heretofore decided, placed the only rolls used at that stage in the defendant's mill.

On the other hand, irrespective of the question of estoppel, if the patent is for a process to be effected without any known means of accomplishing the result; but requiring inventive faculty whereby rolls to accomplish the purposes and their modes of operation were to be determined by new inventions or discoveries, then the patent does not furnish to any one, as then skilled in the art, means whereby the beneficial end could be accomplished. No one in the then existing state of the art could by the use of any rolls known or by any mode of operating the same, have effected the designed end. Consequently to uphold this patent for a process which would have been ineffective without some inventions thereafter had, would be to block the path to all future progress in the art of milling.

The necessary result is that I dismiss the bill—the patent being void for want of novelty, and uncertainty.

Experience with a Home-made Electric Machine.

To the Editor of the Scientific American:

Reviewing my back numbers of the SCIENTIFIC AMERICAN and SUPPLEMENT a short time ago, I became interested in an article headed "How to Make a Dynamo-Electric Machine,"* and having a desire to study the construction of such machines and the principles therein involved, became intensely interested in the article. I digested as thoroughly as possible the practical descriptions and directions there given with a view of constructing one myself. After mastering the details, I set to work and constructed first one and then a second one, both of the same size, and the first one implicitly according to the directions there given, the second one with slight modifications. I think I have been successful in making two fairly good machines.

Probably others of your readers, interested in a like manner as myself, have been engaged in the same thing, and possibly you may know the result of their efforts.

Of course it must be some gratification to you to know that your labors, and the valuable directions and information on practical subjects which you diffuse among your readers, are fruitful of good results. Presuming on this, and claiming your indulgence on that account, and also to afford a comparison with results others have obtained, I will give you a short description of my machines and what they will do.

The two machines, which I call No. 1 and No. 2, stand side by side on a baseboard $10\frac{1}{2}$ by 15 inches, and 1 inch thick. Their general construction is the same as given by you in SUPPLEMENT No. 161, except that a little longer length of wire is wound around each arm of the magnets than there given, and also around the armature, each arm of the magnets containing about 250 feet of No. 16, and each armature about 45 feet of No. 18, covered wire. One drive wheel can run one or both machines at the same time, and to enable me to increase its size, I placed a block of wood 3 inches high on the top of each magnet, with a transverse piece laid across, also 3 inches thick, the whole bolted firmly to the top of both magnets; on the top of this transverse piece stand the bearings for the drive wheel, which is $17\frac{1}{2}$ inches in diameter; it would be better if it was still larger.

Either one machine will heat $3\frac{1}{2}$ to 4 inches of 36 platinum wire to a white heat, and a shorter length to incandescence, and finally melting it. It will rapidly decompose water, producing $1\frac{1}{2}$ cubic inches of gas in two minutes. It produces large bright sparks and strong shocks on breaking contact, and will produce a bright electric light with apparatus described in SUPPLEMENT, No. 149. With both machines combined the effects are very much increased.

By using No. 1 machine to charge the magnet of No. 2, and taking the current from the armature posts of No. 2, I can heat 10 to 12 inches of 36 platinum wire to a white heat, and forming the wire into such a shape as to reduce the radiation, I can heat 14 inches to incandescence, can decompose 1 cubic inch of gas in one minute, heat a thin carbon pencil $1\frac{1}{4}$ inches in length to a white heat the whole length; and as the carbon consumes the brightness increases, until it reaches brilliant incandescence, when it finally disintegrates. Connected in this manner it will also work an induction coil.

With platinum wire I can produce a light equal to six candles, and could do better but for fear of melting the wire. With the electric light apparatus I can produce a light equal to a four foot gas burner.

I am pleased with the machines; they answer nearly all the purposes of a battery, and are always ready, a few turns of the wheel producing a current instantaneously, and continuing steadily so long as you turn the wheel.

I would like to know whether my machines will compare favorably with others. J. PICKARD.

Morrisania, N. Y., March 25, 1880.

[Our correspondent could not have done better with a machine of the size and character described. Few have done as well, although many have made the trial. Some of our correspondents write after this fashion: "I have constructed a dynamo electric machine, carefully following the directions given in your SUPPLEMENT, No. 161, with a single exception"—naming the exception—"and it fails to work!!" Mr. Pickard has made two machines, following our instructions, and they work exceedingly well; others have done the same thing. The fact is the "*single exception*" must be charged with the failure experienced by our unfortunate correspondents.]

THE HUMAN RETINA.—In a recent note to the Vienna Academy Herr Salzer offers an estimate (based on numeration) of the probable number of optic nerve fibers and of retinal cones in a human eye. The number of the former he supposes to be about 438,000, that of the latter 3,360,000. This gives seven or eight cones for each nerve fiber, supposing all fibers of the optic nerve to be connected with cones, and equally distributed among them.

* In SUPPLEMENT, No. 161.

Faber's Talking Machine.

The celebrated Faber talking machine has had its powers of articulation almost doubled by the nephew of the original inventor, also named Joseph Faber. Describing a recent exhibition of the machine, the London *Times* points out that its chief points of interest to the physicist, the physiologist, and, it may be added, the philologist, lie in the results obtained from the ingenious contrivances by which the functions of the flexible and mobile organs of voice are performed. The principal features of the machine are, to begin with, the bellows, from which the air is driven with considerable but varying force, by means of a pedal lever. The air passes in a horizontal stream through a small chamber, which represents the human larynx, and in the same right line out through the mouth. The lips and tongue are of India-rubber, and the lower jaw is movable. Below the laryngeal apparatus, and opening from the chamber in which it is contained, is another smaller chamber, about the size and shape of a lemon, from which a pipe curved upward allows the air when driven through to escape. This supplies the place of the nose to the instrument, and when a valve is opened, enables the sound of the letter *m* and *n* to be produced by the striking of the same keys with which the sounds of *b* or *p* are obtained. The larynx is, of course, the most complex part of the machine, and to Herr Faber is due the elaboration of this portion of the mechanism. Within a small oblong box, a narrow and exceedingly thin strip of hippopotamus bone, strengthened by India-rubber on one side, produces, by its vibrations, the speaking tone, which may be called the fundamental sound to be subsequently modified. At the will of the operator the pitch can be raised or lowered, but not during the utterance of a word or sentence, so that in saying "Mariana," or "*Comment vous portez vous?*" (the machine talks French, German, Italian, or English) the keynote remains unaltered to the end. In front of the vocal cord and within the laryngeal chamber are stops or diaphragms, placed vertically, and rising and falling like the wards of a Chubb's lock, but different in that each stop is a complex machine in itself, having within, moved by a spring, another stop, by means of which an orifice at the base is enlarged or diminished. Herr Faber has taken another liberty with nature, for, besides placing the nose below the mouth, for the sake of convenience, he has placed the teeth in the larynx, or, more strictly speaking, with one of these stops he gets a somewhat lisping "*s*" or the sound "*sh*" from the machine. A small windmill-like arrangement gives the rattle of the letter "*r*," and a thin iron band, notched in the lower rim in front, fitting outside the upper lip, descends to give the "*f*" or "*v*" sound. There are fourteen keys by which sounds are controlled. Striking the first the sound of "*a*" in "father" is produced, the mouth remaining wide open; another key being struck, the lower jaw rises and the sound of "*o*" in "bowl" is given; a third key moves a lever, which nearly closes the mouth, and the sound of "*o*" in "movement" is emitted. The other vowel sounds and the consonants are produced by the use of the diaphragms in the larynx with the mouth in the second or third position.

The French Vintage of 1879.

The gross production of wine in France last year was only 25,700,000 hectoliters (565,400,000 gallons), or 25,000,000 hectoliters (550,000,000 gallons) less than in the previous year. This enormous falling off—nearly one-half—is not entirely attributable to the ravages of the *phylloxera* and *oidium*. These pests have certainly spread widely and rapidly, but, in addition to them, the wine growers had to contend with very unfavorable climatic conditions. The cold and wet which prevailed throughout the year prevented the grapes from fully ripening, and some districts were visited besides with very sharp frosts as early as September. The districts which suffered most severely were the Burgundy and Champagne districts, where the crop is almost entirely destroyed. The south of France suffered less than the east and center. The Departments of L'Aude, Hérault, and Pyrénés Orientales, gave an increase in the production amounting to about 2,000,000 hectoliters, or 44,000,000 gallons. The area of land under vine cultivation was reduced during the year by 51,512 hectares, or 129,000 acres, making the total reduction in the acreage of French vineyards since 1874 no less than 150,000 hectares (370,000 acres). Compared with previous years, it is some satisfaction to find that the rapid diminution in the production of wine in France is not without a parallel. From 1853 to 1856 the produce fell gradually from 22, 21, and 15, to 10 millions of hectoliters in the four years. By 1863 the quantity of wine produced had increased to 50,000,000 hectoliters, and finally, in 1875, it reached the unparalleled figure of 83,000,000 hectoliters. The production of cider last year also fell off, being 4,197,000 hectoliters (92,334,000 gallons) less than in 1878, and more than 3,000,000 hectoliters less than the average of previous years.

Remarkable Shooting.

Another extraordinary marksman, who is said to excel Dr. Carver, is Dr. John Ruth, of California, an account of whose exploits is thus given in a recent issue of a San Francisco paper: "Dr. Ruth then proceeded to give an exhibition of fancy shooting at a glass ball held in the hand of his attendant, be taking aim through his legs, with his back to the object. He also held the rifle with the butt resting upon the top of his head, the hammer pointing downward. He also shot with his back reclining upon a table. In all these experiments he was successful on the first attempt. Turning his back to the attendant, he sighted the rifle by the aid of a small hand mirror, and broke the ball at the first trial. Perhaps the most wonderful feat that he accomplished, and one requiring considerable nerve on the part of both himself and attendant, was shooting a cigar out of the mouth of the latter. Another interesting experiment was shooting without a sight, that essential adjunct being covered by a piece of card board placed around the barrel at its extremity. The absence of the sight apparently made no difference, as the destruction of the vitreous spheres continued unabated. The following experiments were also successfully accomplished: Shooting a ball from the head of an attendant, the latter being blindfolded; the same feat with the bandages removed from the attendant's eyes and the latter looking into the muzzle of the rifle; one hand shooting with a small rifle, manipulated in a variety of difficult ways, holding the rifle with the hands placed back of the neck. In none of these shots did the doctor fail to shatter the balls from the hand of the attendant. One of the most marvelous feats performed was the following: Placing a glass ball upon the ground, the doctor shot in front of it, and plowing under it, sent it flying several feet in the air by the force of the concussion, and before it reached the ground shivering it with a second bullet. Dr. Ruth's wife is nearly as expert as himself in the use of the rifle."

Photographs as Legal Evidence.

The London *Photographic News* thinks that photography is destined to play a very important part in legal proceedings, especially in cases of accident, when the causes are disputed, and when it is essential an exact representation of the condition of affairs immediately after the accident should be laid before a jury. Such photographs, however, require to be executed with some degree of intelligence on the part of the photographer, and an appreciation of the facts of the case, or they may become absolutely misleading. Precise as the camera is, it would not be very difficult, we fancy, by the use of an unsuitable lens, and by the choice of an improper point of sight, to give an idea of the appearance of any place quite foreign from the truth, so far as relative proportion is concerned.

The *News* recites a case where a photographer made a blunder of this kind, which proved very disastrous to his client. The latter was very anxious to obtain a spirit license for a large public house he had built. The chief opposition to his application came from a neighboring Boniface who had had undisputed possession of the custom of the locality for some years, and who, of course, did not want an intruder. The applicant's house was situated on the top of a gentle slope at the corner of two roads, and was really an imposing looking edifice; the opponent's house w[illegible] stunted building, also at the corner of tw[illegible] a considerable frontage on one side. It occurr[illegible] applicant that if he could only lay the photographs of the two houses before the visiting justices they would be so overcome with the contrast presented that they would immediately grant him a license. Accordingly he had the two photographed. Unfortunately the photographer used a short-focus, wide-angle lens, and, selecting his point of sight in respect to the new house opposite the angle (which happened, unfortunately, to be naturally rather an acute one) formed by the two sides of the building, produced a picture in which the two lines of the roof formed almost an isosceles triangle, while the house was squeezed together in the most absurd fashion. The perspective, in fact, was strained and unnatural, and the camera had absolutely made a picture which no human eye (unless it possessed a short focus, wide-angle lens) could by any possibility see. To make the matter worse, instead of meting out the same justice to the old house, the photographer selected a point midway opposite the longest line of frontage, and planted the camera much nearer the object than he did in the first instance. The result was, that the old house in the photograph appeared much the more imposing of the two, and any one who had not seen the originals would have preferred it to the ungainly and disproportioned edifice of which the owner was so proud. At any rate, the justices thought so, and refused the license.

Waste of Fuel.

The wanton destruction of any kind of property is regarded as a crime, and the neglectful waste of the gifts of nature, bestowed for the common good of mankind, no matter how great their present abundance, ought equally to be held as an offense against the rights of humanity, and justly censurable.

Americans are proverbially wasteful, not alone in small matters but in great ones. This is exemplified in a striking manner in the anthracite coal regions of Pennsylvania, where, it is estimated, not less than one hundred million dollars' worth of fuel has been wasted in getting out and preparing the coal for market, the present average annual loss being set down at fifteen million dollars. This enormous waste is ascribed by men of experience to the use of imperfectly designed machinery for breaking the coal. This matter demands serious attention; for vast as are our natural resources, such extravagance will not only tend to exhaust them sooner than they should be, but also to increase present cost to consumers. Land owners and miners are, in this matter, equally remiss in duty to their successors and the people of the country, who have a right to demand that an article of such prime necessity shall be economically worked, in order to yield the best results to the various industries and comforts dependent upon this kind of fuel.

The great cause of this waste in anthracite coal is said by competent engineers to be what are known as coal crushers—toothed cylinders geared to run toward each other, which of necessity literally crush a great part of the coal into fragments and dust too fine for use, unless it can by artificial means be again made into blocks of suitable size. The percentage of waste is estimated at one-fourth the entire product, the greater part of which could be saved to the operators by the use of proper machinery. But the operators, it would appear, are a very conservative set of gentlemen, and opposed to innovations calculated to do away with time-honored methods. It is within the personal knowledge of the writer that a mechanical engineer of wide experience and thoroughly posted in the mining and marketing of anthracite coal invented and set up at one of the great coal centers machinery for the more economical preparation of the fuel. He invited the operators and engineers to come and witness his experiments, but few of them availed themselves of the opportunity; and although, as he claims, he can demonstrate beyond peradventure that he can save from fifty to eighty per cent of the coal now lost, he has as yet been unable to secure the adoption of his improved methods and machinery. This gentleman is a conspicuous example of a prophet being without honor in his own country.—*Coal Trade Journal.*

A New Measuring Implement.

A remarkable machine was described at a recent meeting of the Société d'Encouragement pour l'Industrie Nationale, at Paris, called profilograph, because when in use it traces mechanically on paper the outlines of the ground over which it travels. It is described in one of our foreign contemporaries as a small carriage mounted on two wheels, drawn by one man, and attended by another, who marks the levels at the proper places; and underneath hangs an iron rod with a large ball at its lower end, serving as a pendulum. This pendulum maintains a constant vertical position, while the machine inclines in one direction or the other according as it ascends or descends a slope. To the upper end of the rod is fitted a pencil, which marks on a sheet of paper the ups and downs of the country traversed, whether on an ordinary road or across trackless fields. The exact profile is thus recorded to a given scale. At the same time one of the wheels, acting the part of chain bearer, measures and indicates the distances traveled throughout the survey. For surveyors and others engaged in leveling operations, this machine would appear to be eminently serviceable, and there is talk of its being made use of in a new general survey of France contemplated by the government.

Milk and Lime Water.

Milk and lime water are now frequently prescribed by physicians in cases of dyspepsia and weakness of the stomach, and in some cases are said to prove very beneficial. Many persons who think good bread and milk a great luxury, frequently hesitate to eat it for the reason that the milk will not digest readily: sourness of stomach will often follow. But experience proves, says the *Journal of Materia Medica*, that lime water and milk are not only food and medicine at an early period of life, but also at a later, when, as in the case of infants, the functions of digestion and assimilation are feeble and easily perverted. A stomach taxed by gluttony, irritated by improper food, inflamed by alcohol, enfeebled by disease, or otherwise unfitted for its duties—as is shown by the various symptoms attendant upon indigestion, dyspepsia, diarrhea, dysentery, and fever—will resume its work, and do it energetically, on an exclusive diet of bread and milk and lime water. A goblet of cow's milk may have four tablespoonfuls of lime water added to it with good effect. The way to make lime water is simply to procure a few lumps of unslaked lime, put the lime in a stone jar, and add water until the lime is slaked and of about the consistence of thin cream; the lime settles, leaving the pure and clean lime water on the top.

To Cure Foot Rot in Sheep.

The preparation of the foot is just as essential as the remedy, for if every part of the disease is not laid bare the remedy will not effect a cure. A solution of blue vitriol as strong as can be made and as hot as you can bear your hand in, even for a moment, having the liquid three or four inches deep, or deep enough to cover all the affected parts; then hold the diseased foot in this liquid ten minutes, or long enough to penetrate to all the diseased parts; put the sheep on a dry barn floor for twenty hours to give it a chance to take effect. In every case where I have tried it, it has effected a cure, and I have never given a sheep medicine internally for foot rot. This remedy I call a dead shot when the foot is thoroughly prepared, but a more expeditious way, and where you don't hardly hope to exterminate the disease, but keep it in subjection, is this: After preparing the feet as for the vitriol cure, take butter of antimony, pour oil of vitriol into it slowly until the heating and boiling process ceases, and apply with a swab. This remedy works quicker, is stronger than the vitriol, and is just as safe, but its mode of application renders it less sure.—*Ohio Farmer.*

IN a small part of our issue of April 10, the firm name of the well known manufacturers of printing ink was misprinted. It should have been George Mather's Sons, 60 John street, New York city.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue. ☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

[NOTES & QUERIES]

No atte[illegible]
accompan[illegible]
writer.
Names [illegible]
given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

---

(1) S. H. H. asks how two minerals in powdered form, one specific gravity of 2·5 and the other of 3·5, can be separated. A. Both substances being insoluble in water, a part at least of the former might be obtained by aqueous suspension and defection, as in the purification of kaolin, especially if the lighter is also the softer and finer. The difference is almost too slight for even this, however. Perhaps some marked difference in solubility, fusibility, or polarity (magnetic) exists and may be availed of.

(2) C. C. H. asks for a cheap method of determining the presence of zinc in old pewter and britannia ware. A. Digest a fragment of the metal in a test tube with hot dilute muriatic acid, decant the liquid, and add to it sulphureted hydrogen water in excess; filter off the precipitate, and to the filtered liquid add ammonia water. A white precipitate indicates zinc.

(3) G. A. W. asks: 1. Is the presence of air in steam boilers injurious? A. No. 2. How is air expelled from boilers? A. Generally, when getting up steam, by leaving the safety valve open until the steam blows freely from it. 3. What will restore nickel silver that has been heated to a bluish color? A. Dip momentarily in strong nitric acid, rinse immediately in running water. Polish with crocus or rouge.

(4) W. and B. write: As to the per cent of power produced by overshot water wheels, we know of no tests having been made in this country, and presume there are but few persons competent to make such a test. We have overshot wheels 20½ feet high, which are about worn out and have been urged to use turbines instead, but would like to learn what per cent overshot wheels of our height will give before changing. The turbine claim over 80 per cent. A. As a general result, a good overshot wheel driving machinery not requiring high speeds gives a better percentage than the turbine; for machinery requiring high speeds, a good turbine is to be preferred. A well proportioned overshot wheel should give 65 to 80 per cent; the average turbine will give 60 to 70 per cent.

(5) J. A. M. asks as to the proper size of cylinders for double engine (diameter and stroke); ample size for boiler for same, size of propeller and pitch of same, for fast steam yacht, 55 feet over all, 11 feet beam, 4 feet 3 inches draught at stern, to steam 15 knots at best speed in smooth water. A. For yacht 55 feet long and 11 feet beam, 2 engines, 9 inches cylinder by 8 or 9 inches stroke; propeller 3 feet 10, to 4 feet 2 inches diameter, and 6 feet to 6 feet 3 inches pitch; return tubular boiler about 3 feet 6 inches diameter and 8 feet 6 inches long, with 2 inch tubes.

(6) E. W. T. asks (1) how to stop leaks in boilers, especially at ends of (expanded) tubes. A. If the tubes are not too much wasted away, they can be made tight with a calking or expanding tool. 2. How to prevent foaming in boilers. A. Foaming proceeds from various causes, and until we know the cause, we cannot prescribe a remedy. The design may be faulty, or the circulation bad; too little steam room, or bad water.

(7) J. F. asks: Is there anything that will remove scales from steam boilers without injury to the boiler? A. There are many compounds used for the removal of boiler scale; they are nearly all effective with some kinds of water and useless with others. See our advertising columns for address of makers of boiler compounds. Tannate of soda, sal soda, petroleum, crude or refined, pieces of oak or hemlock bark or oak timber, soda ash, and gum gambier are often used. If the water is muddy, or contain much organic matter, it should be filtered before use.

(8) J. J. H. asks: 1. What is the best means of preventing scale in boilers where hard water is used and boiler inaccessible? A. See reply to J. F. on this page. 2. Ordinarily what horse power is produced on an engine of 8 inches diameter, 12 inches stroke, with 80 lb. steam pressure? A. At 100 revolutions per minute, 16 horse power, and for any other speed in proportion to the speed.

(9) J. J. W. writes: I am compelled to use in my boilers the water from a stream that is muddied by the washing of iron ore. It causes them to foam. Can you suggest any remedy, or manner by which I could use it without said result? A. See reply to J. F. on this page.

(10) H. L. C. asks: About what is the relative temperature of the water and the steam in a steam boiler when under pressure of 40 to 100 lb. per square inch? A. After a boiler has been in operation long enough for a thorough circulation, the temperature of the water is same as the steam, and the latter determined by its pressure, if there be no superheating.

(11) J. H. J. asks (1) for the proper mode of adjusting the slides of an engine in working position. A. A line is drawn through the center of the cylinder, and the slides set parallel to it in both directions. 2. To keep the rod the proper length in packing brasses. A. Have the draught of the key at one end of the rod in one direction, and of the other end in the opposite direction. 3. To obtain the half stroke of piston. A. The half stroke of the piston is the length of the crank.

(12) J. D. asks: 1. Can water be heated to a higher temperature than 212° Fah.? A. Yes. 2. How much greater percentage can I get from a copper heating surface than iron surface in a boiler, built locomotive style? A. Practically there is little or no difference between copper and iron.

(13) E. R. M. asks: Would a young mechanic make a locomotive runner with practice on the road with a good engineer that has had four years' experience with different kinds of steam engines, and have studied both Forney's and Roper's Catechisms of the Locomotive? A. Yes, with self-reliance, close observation, and industry.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

N. G. Co.—It is a variety of serpentine resembling coralite, a hydrosilicate of magnesia. (see p. 465, Dana's Mineralogy.)—A. G. S.—It is fool's gold, iron pyrites, sulphide of iron.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 23, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Agricultural boiler, D. Feigar 225,904
Agricultural implement, W. A. Chapman 225,690
Animal trap, G. W. Lindsey 225,708
Animal trap, J. Quigley 225,768
Annunciators, push key attachment for, J. F. Martin 225,943
Bag tie, J. Hill 225,900
Baling press, portable, S. M. Watts 225,773
Barrel damper, Briggs & Jones 225,792
Basin, wash, H. A. Shelley 225,690
Bed and bolster woven wire, Wagner & Friedrich 225,787
Bed, wardrobe, N. G. Hood 225,765
Beer, etc., treating, Musgiller & Schedler (r) 9,120
Bell, call, J. P. Connell 225,690
Binder, temporary, White & Van Zullen 225,901
Bisulphide of carbon engine, W. S. Colwell 225,699
Bit brace, N. Spofford 225,704
Boiler and heater, combined, D. Hawkins 225,623
Bonds, notes, and other evidences of value, S. R. Dummer 225,748
Boot and shoe calk plate, J. B. Weir 225,992
Boot and shoe lasting device, A. Davidson 225,896
Boot and shoe soles, extensible pattern for cutting, Simon & Lax 225,874
Boot treeing machine, J. E. Crisp (r) 9,124
Bridge, lifting, E. B. Whitmore 225,725
Bridle bit, T. T. Furlong 225,731
Brush, galvanic, P. H. Roth 225,728
Bugs from potato vines, machine for removing, G. K. Risley 225,870
Bung, vent, O. Zwietusch 225,866
Button for cuffs, etc., H. E. Moore 225,864
Button, separable, G. K. Webster 225,886
Cabinet, exhibiting, J. F. Martin 225,841
Canister, C. A. Fredericks 225,816
Car brake, automatic, H. Skinner 225,961
Car coupling, R. F. Krohn 225,840
Cars, sand distributor for street, S. S. Wood 225,904
Carpet lining, G. S. Page 225,718
Carriage bows, spring support for, Wilgus & Johnson 225,789
Cart, coal, V. D. P. J. Slattery 225,736
Caster, pickle, W. C. Beattie 225,796
Chains, manufacture of jewelry, R. F. Simmons 225,879
Change and delivering tickets in street cars, stores, etc., making, H. B. Robbins 225,872
Charm and similar articles of jewelry, F. E. Gilbert 225,821
Chuck, drill, R. E. Wilcox 225,982
Churn, J. D. Hobbs 225,833
Churn power, J. S. Smith 225,727
Churn power, Y. H. Winchell 225,777
Cigar box for preventing revenue frauds, P. McAleer 225,849
Clock, calendar, W. H. Stewart 225,988
Coffee roaster stirrer, R. J. Morton 225,758
Collar, standing, Goldsmith & Merrill 225,660
Coloring matter, artificial, F. Z. Roussin 225,868
Colter, rolling, L. Chapman 225,748
Cooker, steam, W. S. Wood 225,916
Cornice, window, J. R. Shackleton 225,677
Corset clasp, W. McCabe 225,849
Cotton chopper, J. Y. Surtaire 225,881
Cotton chopper and cultivator, J. B. Nichols 225,856
Counter stiffeners, machinery for shaping, G. L. Roth 225,875
Crayon sharpener, J. Sulzer 225,772
Cultivator, T. C. Darby 225,692
Curtain bracket, H. T. Warner 225,904
Curtain fixture, F. B. Scott 225,725
Curtain roller, W. B. Noyes 225,857
Cuspadore, J. M. Wheeler 225,774
Cut-off, steam engine, W. Redmond 225,866
Cutting blade handle, extension, W. Webster 225,906
Dental disk, felt, W. W. Smith 225,884
Disinfecting device for urinals, etc., E. J. Mallett, Jr. 225,842
Dog iron mould, J. McDermott 225,712
Door, J. F. Martin 225,847
Door, screen, J. Barkheimer 225,680
Draught equalizer, F. Marsh 225,710
Draught regulator for barrows, P. H. Nelson 225,750
Dress stiffener, N. Jenkins 225,734
Drill and bit stock, combined, S. A. Bostwick 225,682
Eave trough hanger, A. H. Braunlich 225,694
Egg beater, J. Emmert 225,692
Electric motor, L. M. Sabin 225,724
Electrical conductor, E. U. Parod 225,961
Elevator and scales, combined, G. Van Winkle 225,902
End gate, W. Culbertson 225,803
Engraving machine, J. Hope 225,705
Envelope, H. & L. Planche 225,864
Evaporating apparatus, steam, D. K. Allington 225,751
Excavator, S. W. Bohn 225,674
Exercising machine, E. A. Tuttle 225,776
Expanding drill, L. F. Pond 225,730
Farm gate, I. Bush 225,691
Fence, barbed, T. G. Orwig 225,717
Filter, W. A. Pitt 225,963
Firearm, magazine, W. H. Elliot 225,750
Fluting machine, H. Albrecht (r) 9,127
Forging wrench heads, die for, L. Chapman 225,745
Fruit jar, Griswold & Moran 225,702
Fuel, combustion of, R. J. Brooks 225,793
Gas engine, Wittig & Hees 225,778
Gas, manufacture of nitrogen, T. B. Stillman 225,730
Gas producer, A. Faber du Faur 225,812
Gate, B. F. Luce 225,841
Glass stones to metallic frames, securing moulded, J. Fischer 225,816
Glass, wood, rubber, etc., ornamenting smooth surfaces of, R. Cunningham 225,922
Grain and seed separator, D. Geiser 225,646
Grain, etc., apparatus for purifying, O. Oexle 225,859
Grain crushing roll, J. Stevens 225,770
Grain meter, C. H. Horton 225,834
Harness, J. Habel 225,826
Harrow, A. C. Evans 225,694
Harvester reel, J. M. Moore 225,851
Hat brims, machinery for stretching, A. Alexander 225,782
Hat pouncing machine, W. Keenan (r) 9,125
Hoisting apparatus, C. R. & N. P. Otis (r) 9,128
Hoisting jack, D. W. Smith 225,882
Horse rake, B. Owen 225,716
Horse rake, G. H. Smith 225,966
Horses, apparatus for holding, D. B. Middleton 225,715
Hose, fire, J. K. Gillespie 225,698
Hose nozzle, adjustable, A. B. Prouty 225,721
Hub attaching device, S. A. Fuller, Jr. 225,819
Hub attaching device, Z. Huggins 225,836
Ice plow, I. Boone 225,776
Injector, J. S. Eberman 225,749
Ink, manufacture of printing, J. Kircher (r) 9,126
Insecticide compound, J. K. Gibson 225,697
Insulating telegraph wires, A. K. Eaton 225,811
Iron skelping machine, J. Hoeveen 225,635
Jacquard machine, J. Miesch 225,852
Jewelry, F. E. Gilbert 225,820
Jewel case, W. C. Beattie 225,797
Ladder step, J. Hill 225,901
Lamp and swing bracket, device for supporting a, M. A. Dees 225,807
Lamps, decorating glass, J. W. Haine 225,701
Lantern, E. J. Brooks 225,794
Lantern burner, G. A. Beidler 225,790
Lantern, signal, Smith & Murdock 225,880
Latch, T. S. Livermore 225,707
Latch, C. H. Smith 225,729
Leather, finishing, Tice & O'Connell 225,772
Lock, A. B. Detts 225,808
Matting, straw, W. H. Townsend 225,735
Measure and funnel, combined, G. A. Keene 225,756
Mechanical movement, C. Hammelmann 225,702
Metal surfaces, machine for ornamenting, Hewitson & Tolman 225,829

Metal surfaces, tool for ornamenting, J. Hewitson	225,829
Microphone, E. Berliner	225,790
Middlings purifier, T. D. Isbell	225,738
Milk and cream cooler, B. H. Reynolds	225,764
Milk, etc., jar, L. P. Whiteman	225,900
Mower, lawn, F. Hanson	225,703
Non-conducting covering, B. F. Smith	225,767
Nut lock, E. A. Mercer	225,718
Oil burner, A. T. Jones	225,896
Oil can, C. F. Heath	225,835
Organ pedal, H. R. Moore	225,856
Paper bag machine, E. Stanley	225,897
Paper cutter, J. T. Robinson	225,871
Paper hanger, automatic, R. R. Pattison	225,900
Paper, manufacture of non-inflammable, C. H. O'Connor	225,858
Pen, stylographic fountain, A. T. Cross	225,801
Pen, stylographic fountain, C. H. Downes	225,810
Pianoforte key, J. W. Haines	225,709
Planter attachment, corn, J. A. Werner	225,900
Planter, corn, B. Phelps	225,719
Planting machine, seed, A. Dart	225,804
Plow, F. Stanley	225,789
Plow, wheel, L. Chapman	225,744
Poles or posts, socket for wooden, A. Brady	225,693
Pressure regulator, fluid, G. Westinghouse, Jr.	225,698
Printing machines, supplement introducing mechanism for, L. C. Crowell	225,748
Pruning implement, G. J. Cline	225,799
Railway and farm gate, C. A. Daniels	225,805
Railway switch stand and lock, R. R. De Yoni	225,167
Ratchet regulator for transoms, etc., J. T. O'Donoghue	225,761
Refrigerator, J. D. Richardson	225,869
Register border, A. H. Tingley	225,900
Rein holder, J. D. Bentley	225,789
Road engine, F. L. Fairchild	225,696
Roof, sheet metal, R. G. Sykes	225,730
Roofing plate, illuminating, J. Jacobs	225,867
Salt cellar and pepper box, W. C. Beattie	225,793
Saw, A. A. Burr	225,796
Saw mill, A. P. Barlow (r)	9,132
Scarf, W. W. Fichtenberg	225,815
Screw press die holder, J. McWilliams (r)	9,133
Seaming machine, sheet metal, G. D. Brooks	225,695
Sewage transportation tank, R. A. McCauley	225,900
Sewer trap, etc., valve, W. Wilson	225,778
Sewing machine, C. M. Banks	225,794
Sewing machine table, J. B. Donovan	225,809
Shafting hanger, A. Lochner	225,720
Sheet metal, machinery for cleaning and polishing, W. H. Camp	225,796
Ships in port, ballasting, P. Corvaja	225,803
Shoe sole trimming and channeling machine, J. Smith	225,729
Sign, N. Stow	225,901
Snap hook, F. Kortick	225,736
Spark arrester, D. B. Stalker	225,896
Spirometer, J. P. Marsh	225,710
Spool, G. P. Benjamin	225,790
Spout, sap, S. A. Pierce	225,762
Steam and hydraulic elevator, combined, J. B. McPherson	225,851
Steam boiler, L. Rivet	225,722
Steamer, food, O. Van Tassell	225,900
Stove, D. L. Ervin	225,812
Stove burner, gas, W. Blessner	225,740
Stove grate, J. W. Kilmeline	225,700
Stove, parlor cooking, T. B. Baldwin	225,700
Stove, portable, R. E. Agard	225,740
Strainer, tea and coffee pot, G. N. Root	225,766
Suspenders, J. Hayden	225,834
Target, W. A. Tangeman	225,734
Teeth, composition for filling, T. Fletcher	225,817
Telephonic exchange system and device, W. A. Childs	225,797
Thill coupling, S. M. Rhoads	225,867
Thrashers, etc., shoe for grain, A. H. Johnson	225,840
Time lock, O. B. Pillard	225,862
Tobacco, machine for making plug, E. T. Pollard	225,863
Tobacco, purifying, W. Wohltmann	225,900
Tobacco rolling and cutting machine, H. W. Holley	225,823
Tool handle, Richardson & Calhoun	225,868
Traction engine gearing, W. Heilman	225,827
Truck, car, W. T. Browne	225,741
Urn, coffee, C. B. Stilwell	225,731
Valve and muffler, safety, G. H. Crosby	225,801
Valve, gate, H. Mather	225,713
Valves, gear for automatic action of throttle and slide, C. B. Cook	225,799
Vegetable cutter, H. Boerstler	225,691
Velocipede, W. Overstreet	225,760
Velocipede, R. W. Tesse	225,771
Wagon brake, Talley & Wadlington	225,891
Wagon running gear, W. Carr	225,697
Wagon running gear, Y. E. Sawyers	225,876
Wagon, side spring, W. Wright	225,779
Washing machine, C. H. Miller	225,734
Watches, pendant for stem winding, J. T. Rossetti	225,874
Wheat drill, S. F. Carson	225,742
Window safety device, R. D. Heureuse	225,704
Wire conductor, J. F. Martin	225,843
Wire conductor for houses, J. F. Martin	225,841
Wood, artificial, W. Grossmann	225,822

DESIGNS.

Aerated liquids, apparatus for dispensing, C. B. Hires	11,699
Carpeting, J. Forrester	11,701 to 11,703
Carpeting, F. W. Green	11,704
Carpeting, E. Poole	11,705 to 11,707
Lace pins, B. A. Bliss	11,692
Ornamenting plates and dishes, F. A. Marra	11,697
Pencil case, C. H. Court	11,693
Spoons, forks, etc., L. S. White	11,700
Umbrella handles, Heiter & Lesem	11,694 to 11,696, 11,698

TRADE MARKS.

Cement, Ohio Cement Company	7,935
Teas, green, Japan, and black, Fraser & Co. (China)	7,950
Toilet powder, Lecuna Bros.	7,956, 7,957

English Patents Issued to Americans.

From March 19 to March 23, 1880, inclusive.

Electric railway signal, T. A. B. Putnam, New York city.
Furnaces, heating, H. L. Brooke, Baltimore, Md.
Governors for marine engines, W. U. Fairbairn et al., Boston, Mass.
Horseshoe nail machinery, J. B. Wheeler et al., Lynn, Mass.
Horseshoe nail machinery, J. Capewell, Cheshire, Conn.
Insulation of underground telegraph wires, C. Linford, Pittsburg, Pa.
Knife cleaning machine, J. F. Walters, Boston, Mass.
Photography (2), E. J. Muybridge et al., San Francisco, Cal.
Steam boiler, E. H. McNiel, Boston, N. Y.
Valve for steam pipes, etc., W. Wilson, Oakland, Cal.

Rose on the Slide Valve

NOW READY.

The Slide Valve practically explained, embracing simple and complete practical demonstrations of the operation of each element in a slide-valve movement, and illustrating the effects of variations in their proportions, by examples carefully selected from the most recent and successful practice, by JOSHUA ROSE, M.E., author of "The Complete Practical Machinist," "The Pattern Maker's Assistant, etc., etc.; illustrated by 35 engravings, 12mo, cloth, $1.00 by mail, free of postage.

PREFACE.—The object of this book is to present to practical men a clear explanation of the operations of a slide valve under the conditions in which it is found in actual practice. The author believes that its clear and concise treatment of the subject will leave nothing to be desired, even by those who begin it in entire ignorance of the subject matter.

CONTENTS.

Simplest form of valve; Lead and its effects; Diagram of simple valve action; Steam lap explained; Diagram showing effects of steam lap; The angularity of the connecting rod and its effect on the valve action; The eccentric piston and crank movements; Exhaust lap explained; Diagram showing effects of exhaust lap; Clearance explained; Effects of clearance; Valve travel considered; Effect of over travel on the position of the eccentric and port openings; Point of cut-off; The rock shaft and its effect on the position of the eccentric and on the distribution of the steam; Examples from practice; Comparison of the merits of the various examples, of port areas, of compression, of expansion, of exhaust areas, of valves of exhaust areas, of ports to their duty, of areas of wearing surface; Rules for areas of steam ports; Shapes of ports; Power required to operate valve; Conditions as affecting friction; Warping of valves; Setting of valves from pressure; Coefficient of friction; Practical experiments on friction; Size of valve as affecting friction; Lubrication of slide valves; Ascertaining with a pair of compasses the result to be obtained from a given slide valve; To ascertain point of full steam port opening, position of piston when port is full open, point at which valve begins to close, point of cut-off, amount of expansion, point of release, point at which exhaust begins, point of full exhaust opening, point where cushioning began, amount of cushioning; To set a single eccentric without moving the engine, a double eccentric without moving the engine, eccentrics when the rod is not in line with the cylinder bore.

Also for sale:

Armstrong.—The Construction and Management of Steam Boilers. Illustrated. 12mo. $0 75

Baker.—Mathematical Theory of the Steam Engine. Illustrated. 12mo. $1 75

Bourne.—Examples of Steam, Air, and Gas Engines of the most Recent Approved Types as employed in Mines, Factories, Steam Navigation, Railways and Agriculture, Practically Described, with an account of all the Principal Projects for the Production of Motive Power from Heat. By John Bourne, C.E. Illustrated by 34 plates and 256 wood-cuts. Over 300 pages. 4to. $30 00

Bourne.—A Treatise on the Screw Propeller, Screw Vessels, and Screw Engines, as adapted for Purposes of Peace and War. Illustrated. 4to. $30 00

Bourne.—Recent Improvements in the Steam Engine. $1 50

Burgh.—Practical Rules for the Proportions of Modern Engines and Boilers for Land and Marine Purposes. 12mo, cloth. $1 50

Campin.—A Practical Treatise on Mechanical Engineering; comprising Metallurgy, Moulding, Casting, Forging, Tools, Workshop Machinery, Mechanical Manipulation, Manufacture of Steam Engines, etc. 8vo. Illustrated with 29 plates and 100 wood engravings. $6 00

Colburn.—The Locomotive Engine. Including a description of its structure, rules for estimating its capabilities. Illustrated. 12mo. $1 25

Donaldson.—Drawing and Rough Sketching for Marine Engineers. Illustrated. 8vo. $2 25

Edwards.—A Catechism of the Marine Steam Engine. For the use of Engineers, Firemen, and Mechanics. A Practical Work for Practical Men. By Emory Edwards, Mechanical Engineer. Illustrated by 60 engravings, including examples of the most Modern Engines. 12mo. $2 00

Laidner.—The Steam Engine for Beginners. Illustrated. 12mo. $0 75

Main and Brown.—The Marine Steam Engine. With numerous illustrations. In 1 vol. 8vo. $5 00

Main and Brown.—The Indicator and Dynamometer. With their Practical Applications to the Steam Engine. Illustrated. 8vo. $1 50

Main and Brown.—Questions on Subjects Connected with the Marine Steam Engine and Examination Papers. 1 vol. 12mo. $1 50

Norris.—A Handbook for Locomotive Engineers and Machinists, comprising the proportions and calculations for constructing locomotives; manner of setting valves. Illustrated. 12mo. $2 00

Templeton.—The Practical Examinator on Steam and the Steam Engine with Instructive References relative thereto, arranged for the use of Engineers, Students, and others. By Wm. Templeton. 12mo. $1 25

Wilson.—A Treatise on Steam Boilers: their Strength, Construction, and Economical Working. By Robert Wilson. Fifth Revised Edition. In one volume. 12mo. Price. $2 50

Warn.—The Sheet Metal Worker's Instructor. For Zinc, Sheet Iron, Copper and Tin Plate Workers, etc. Containing a selection of Geometrical Problems; also, Practical and Simple Rules for describing the various Patterns required in the different branches of the above Trades. By Reuben H. Warn, Practical Tin Plate Worker. To which is added an Appendix, containing Instructions for Boiler Making, Mensuration of Surfaces and Solids, Rules for Calculating the Weights of different Figures of Iron and Steel, Tables of the Weights of Iron, Steel, etc. Illustrated by Thirty-two Plates and Thirty-seven Wood Engravings. 8vo. $3 00

☞ The above or any of our books sent by mail, free of postage, at the publication price.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo; a Catalogue of Books on DYEING, CALICO PRINTING, WEAVING, COTTON and WOOLEN MANUFACTURE, 4to; Catalogue of a choice collection of PRACTICAL, SCIENTIFIC, and ECONOMIC BOOKS, 4to; List of Books on STEAM AND THE STEAM ENGINE, MECHANICS, MACHINERY, and ENGINEERING, 4to; List of Important Books on METALLURGY, METALS, STRENGTH OF MATERIALS, CHEMICAL ANALYSIS, ASSAYING, etc., 4to; List of Books on MINING, MINING MACHINERY, COAL, etc., 4to; two Catalogues of Books and Pamphlets on SOCIAL SCIENCE, POLITICAL ECONOMY, BANKS, POPULATION, PAUPERISM, and kindred subjects; a Catalogue of recent additions to our stock of PRACTICAL, SCIENTIFIC, AND TECHNICAL BOOKS; as well as a List of LEADING BOOKS ON METAL MINING, METALLURGY, MINERALOGY, ASSAYING, AND CHEMICAL ANALYSIS, sent free to any one who will forward his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.

FIRE BRICK, TILE AND CLAY RETORTS ALL SHAPES. BORGNER & O'BRIEN, 23D ST., ABOVE RACE, PHILADELPHIA.

Shafts, Pulleys, Hangers, Etc.

Full assortment in store for immediate delivery.
WM. SELLERS & CO.,
79 Liberty Street, New York.

MACHINISTS' TOOLS.
Iron Planing Machines

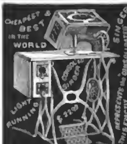
A SPECIALTY.
C. WHITCOMB & CO., Worcester, Mass.


ALAND'S Silent Injector, Blower & Exhauster. Apply to S. ALAND, Rome, Oneida Co., N. Y.


A MANUFACTURER WANTED TO make Sedans' Patent Weighted Horse-shoe as described in this journal Feb. 14th. Address J. S. BROWN, Galveston, Texas.

WANTED,

A competent and reliable man as "Time Keeper" in a general machine shop and foundry employing 300 to 400 men. Must be thoroughly experienced. Address H. W., Box 773, New York.



Consolidated Singer.

The CONSOLIDATED MACHINE CO. have adopted a new plan of selling Sewing Machines, and hereafter will sell direct to the consumer our celebrated Consolidated Singer Sewing Machine, as shown in the annexed cut, for ONLY

$22

The patents having expired, it is now generally understood that any person or company has the right to manufacture Sewing Machines, thus offering to any one the privilege of building machines and competing with old monopolies who have so long been, and are now, charging the public enormous prices for an article that should be in every home. Taking advantage of these facts, and knowing the immense number of machines that are being sold at high prices, our company was organized for the purpose of supplying direct Sewing Machines at a fair profit to ourselves and a WONDERFUL SAVING TO THE BUYER. To do this, it was necessary for us to depart from the expensive plan pursued by old companies of opening elegantly fitted up salesrooms in every city and town in the country, and of appointing an agent in each place and pay as his commission more for selling a Machine than we charge for one delivered. Our plan is to have but ... materials and sell machines for cash DIRECT TO THE BUYER. ... of our plan, we are now shipping Machines to many parts of Europe ... in the United States—not alone to families, but to dealers, who pay the above prices whether they buy a single Machine or order by the dozen.

☞ THE GRANDEST OFFER MADE BY A RESPONSIBLE FIRM. ☞ On receipt of price as given above, we will ship a Machine and guarantee it to reach its destination safely. This Machine is well and favorably known throughout the world for its excellent qualities. The parts throughout are nicely polished, and the woodwork is elegant, being made of Solid Black Walnut, and handsomely veneered, paneled and polished, having two side drawers with fancy knobs and brass drop handles, and drop leaf table ... We elegantly ornament the head of each Machine in the Highest Style of the Art. The stands are handsomely japanned, thus making each a Perfect and Beautiful Machine. With each Machine we furnish FREE the following Attachments, viz.: *1 Foot Hemmer, 6 Bobbins, 1 Bobbin Winder, 1 Guide, 1 Guide Screw, 1 Wrench, 1 Extra Needle Plate, 1 Braider, 1 Quilter, 1 Extra Check Spring, 1 Screw Driver, 1 Oil Can, 1 Bottle Consolidated Machine Co. Oil, 1 Package Needles, and a Book of Instructions*, so that any one can run a machine without a teacher.

☞ EVERY MACHINE IS WARRANTED IN PERFECT RUNNING ORDER AND AS REPRESENTED OR MONEY REFUNDED.

We wish to put you on your guard against misrepresentations of agents, many of whom will say or do anything to make a sale for themselves, as they feel we are injuring their business. We admit that we are, but at the same time saving to our customers many dollars on the cost of a household necessity. All we ask is a trial in any neighborhood. ONE OF OUR MACHINES WILL SELL DOZENS. We warrant this Machine NEW. ... Our *Consolidated Singer* is new in every part and portion, and if not found so, we will Forfeit ONE THOUSAND DOLLARS. *As an Additional Inducement* to introduce our Machines, and if ordered within 90 days from date of this paper, we will pay all shipping charges, providing your nearest railroad station is in or East of Minnesota, Iowa, Missouri, Arkansas or Texas. If you live West of any of the above mentioned States, and you will send us an order within 90 days, we will allow you to retain $3.00 from the price of the Machine, and you to pay the shipping charges when the Machine is received. Remember this is a special offer and only good for 90 days. Owing to the large number of Machines we are shipping, we have arrangements with Transportation Companies by which we can ship a Machine, weighing a hundred pounds, as far West as Sacramento, California, for only $5.00, and to other Far-Western points at proportionate rates. In ordering, mention this paper, give your Post Office address and nearest Railroad Station. Send Money by Registered Letter, Post Office Money Order, or Draft on New York, made payable to our Company. We ship Machine on day ORDER IS RECEIVED. As to our responsibility, we refer to any Bank, Express Company, or to any reputable business house in this city, and by permission, to the publisher of this paper. Address the

CONSOLIDATED MACHINE CO., 702 Broadway, New York City, U. S. A.

Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

AGENTS Catalogue free. $7 per day made easy. J. F. GAGE & CO., Boston, Mass.

Universal Hand Planer, Judson's Patent.

... WHITLEY & CO. European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 1 Poultry, E.C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
235 BROADWAY, NEW YORK.

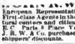
SHEPARD'S CELEBRATED $60 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO.,
331, 333, 335, & 337 West Front Street, Cincinnati, Ohio.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

BIG Inducements to secure agents to sell our goods. Terms and circulars free. Address the manufacturers, GEO. VAN SANDS & CO., Middletown, Conn.



Forster's Rock & Ore Breaker and Combined Crusher and Pulverizer.

The simplest machine ever devised for the purpose.
Parties who have used it constantly for six years testify that it will do double the work of any other Crusher, with one-third the Power, and one-half the expense for keeping in repair. The smaller sizes can be run with Horse Power.
Address TOTTEN & CO., Pittsburgh, Pa.

FOR SALE,

Extra Strong Screw Presses, Calender Rolls, and other machinery connected with the manufacture of R. R. cards and tickets. This offers an excellent opportunity for any one desirous of a profitable business with an unlimited demand. Address GEO. BAILEY, 280 Pearl St., Buffalo.

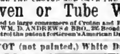
THE BEST THING YET. THE Fitchburg Acoustic Telephone Co.'s New Metallic Telephone. Send for circulars.
FITCHBURG ACOUSTIC TELEPHONE CO.,
Box 34, Old City, Fitchburg, Mass.

SPARE THE CROTON AND SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N.Y., who control the patent for Green's American Driven Well.

XX COT (not painted,) White Duck $2.



Makes a perfect bed. No mattress or pillows required. Better than a hammock, as it fits the body as pleasantly, and lies straight. Folded or opened instantly. Self fastening. It is just the thing for hotels, offices, cottages, camp-meetings, sportsmen, etc. Good for the lawn, piazza, or "coolest place in the house." Splendid for invalids or children. Sent on receipt of price, or C. O. D. For 50 cts. extra, with order, I will prepay expressage to any railroad station east of Mississippi River and north of Mason and Dixon's line. For 75 cents, in Minnesota, Missouri, and Iowa.
HERMON W. LADD, 108 Fulton St., Boston; 207 Canal St., New York; 165 North Second St., Philadelphia. Send for Circulars.

PORTER MANUF'G CO.

The New Economizer, the only Agricultural Engine with Return Flue Boiler in use. Send for circular to Porter Mfg. Co., Limited, Syracuse, N.Y.

G. G. YOUNG, Gen. Agt., 42 Cortland St., New York.

No Sawdust! No Planing!

Thin lumber, 1-16 to ½ inch thick, cut and seasoned by our recently patented machines, equal if not superior to the sawed and planed, smooth, flat, and in all cases perfectly seasoned. Used by the largest manufacturers in the country, and giving entire satisfaction. In addition to our specialty, our usual complete stock of sawed Hardwood, Lumber, and Veneers, figured and plain, Burls, etc.

GEO. W. READ & CO.,
186 to 200 Lewis Street, New York.

Has More Good Points, Does More and Better Work, Takes Less Power, Than any Hammer in the World.
BRADLEY & COMPANY, SYRACUSE, N.Y.

The Premium  Bucket.

DUC'S IMPROVED ELEVATOR BUCKET.

Made in sizes from 1½ to 20 inches. For use in FLOUR, GRAIN, MALT, ORES, COAL, BROKEN STONE, SAND, DUCKS, SPICES, PLASTER, etc., etc. These buckets are struck out from the best charcoal iron, and are almost indestructible. No corners to catch. No seams to burst. Run with great ease and fill full every time. No interior corners to clog up.
T. F. ROWLAND, Sole Manufacturer, Brooklyn, N. Y.

KNOW THYSELF.

THE untold miseries that result from indiscretion in early life may be alleviated and cured. Those who doubt this assertion should purchase the new medical work published by the PEABODY MEDICAL INSTITUTE, Boston, entitled THE SCIENCE OF LIFE; or, SELF-PRESERVATION. Exhausted vitality, nervous and physical debility, or vitality impaired by the errors of youth, or too close application to business, may be restored and manhood regained.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jewelled medal by the National Medical Association. It contains beautiful and very expensive engravings. Three hundred pages, more than 50 valuable prescriptions for all forms of prevailing disease, the result of many years of extensive and successful practice, either one of which is worth ten times the price of the book. Bound in French cloth; price only $1, sent by mail postpaid.

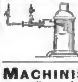
The London *Lancet* says: "No person should be without this valuable book. The author is a noble benefactor."

An illustrated sample sent to all on receipt of 6 cents for postage.

The author refers, by permission, to JOS. S. FISHER, president; W. I. P. INGRAHAM, vice-president; W. PAINE, M.D.; C. S. GAUNTT, M.D.; H. J. DOUCET, M.D.; R. H. KLINE, M.D.; J. R. HOLCOMB, M.D.; N. R. LYNCH, M.D., and M. R. O'CONNELL, M.D., faculty of the Philadelphia University of Medicine and Surgery; also the faculty of the American University of Philadelphia; also Hon. P. A. BISSELL, M.D., president of the National Medical Association.

Address Dr. W. H. PARKER, No. 4 Bulfinch Street, Boston, Mass. The author may be consulted on all diseases requiring skill and experience.

HEAL THYSELF.



THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators,
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

PATENTS

CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 20, 1866, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 20, 1866, at which time the Patent Office commenced ... drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

PROSPECTUS
OF THE
Scientific American
FOR 1880.
The Most Popular Scientific Paper in the World.

VOLUME XLII. NEW SERIES.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States, Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

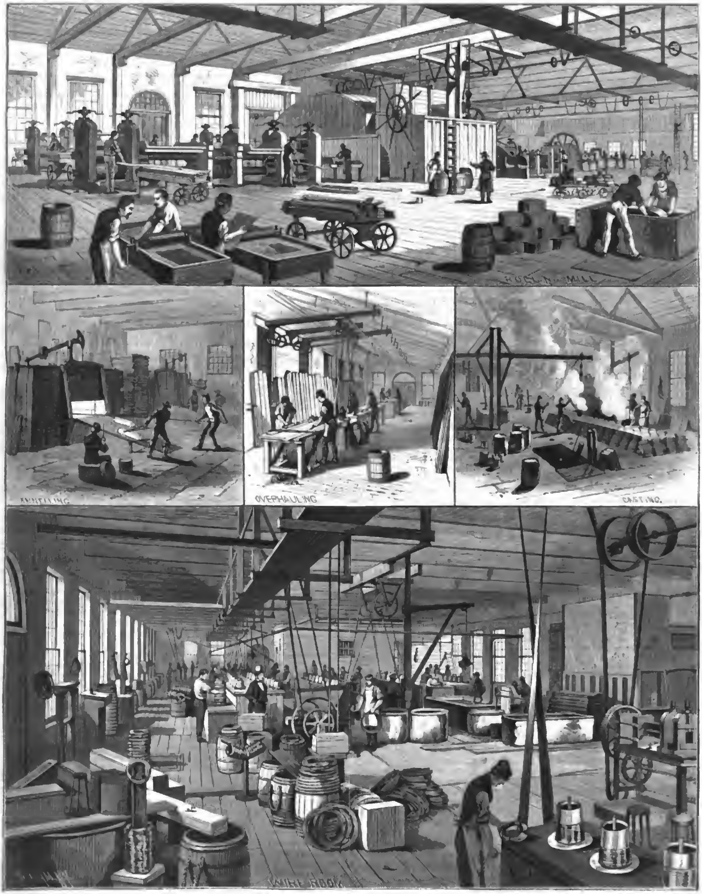
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 18. [NEW SERIES.] | NEW YORK, MAY 1, 1880. | $3.20 per Annum. [POSTAGE PREPAID.]



BRASS MANUFACTURE.—BENEDICT & BURNHAM MANUFACTURING COMPANY, WATERBURY CONN.—[See page 277.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH

NEW YORK, SATURDAY, MAY 1, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 226,

For the Week ending May 1, 1880.

Price 10 cents. For sale by all newsdealers.

ELEVATED CITY RAILROADS.

The decision of the Superior Court against the Metropolitan Elevated Railroad Company, in the recent trial case, attaches a new interest to the subject of rapid city transit. This suit was brought by Dr. Caro, the owner of a house on Fifty-third street, to recover damages sustained by the passage of the elevated road in front of his dwelling.

This street is hardly surpassed for fine residences and beauty by any in the city. The effect of the elevated road has been to reduce the market and rental value of property on its line. When the road was first constructed the best houses were rapidly emptied of their occupants, and even at a great reduction in rent were difficult to fill with tenants. The people along the line of the railway have now become more accustomed to the railway nuisance, yet nearly the same reluctance holds to renting or locating on those avenues or streets where the railway exists. The injury done to property owners on such a street as the Fifty-third is no trifling consideration.

The case we have cited has been argued by eminent counsel. The former decision of the court was in favor of the company; it claimed the right to the use of the street, even though by a new and unusual way, as by cars propelled by steam upon an elevated road.

The Superior Court has decided that the rights of real estate owners extend beyond the limits of the street to the exclusion of whatever may tend to depreciate their property or render their homes unpleasant, unless properly remunerated. The case will doubtless pass to the Court of Appeals for final decision.

The concurring opinions of Judge Speir and Chief-Justice Curtis are elaborate, covering the grounds claimed by plaintiff. They set forth that plaintiff is owner of the premises in Fifty-third street, and as such is entitled to their undiminished enjoyment and advantage. The law protects property owners in these rights against everything that may injure their property or render their homes unpleasant. No one has a right, even on his own premises, to do aught that would injure the property of his neighbor. The decision in this case is to the effect that noxious gases, disturbing noises, shutting out air and light, are, in point of law, real invasions of the owners' premises. They depreciate greatly the market and rental value of the property, and render the dwelling less pleasant as a home.

Should the Court of Appeals decide that the company shall fully remunerate the property holders along the line of the road, the final expense must fully equal, if not exceed, the original estimate of the underground line.

The recent decision has affected the price of the company's stock, and should the Court of Appeals render an adverse decision, it can but affect still more the company and the market value of the property of the elevated railroad.

THE WIRE GAUGE.

The want of a uniform and generally accepted system of numbering and grading the different thicknesses of wire and sheet metal has for a long time been felt as a serious inconvenience, both by manufacturers and consumers. For particular purposes, or in filling large orders, where it is worth while to figure for the size of wire to a very small fraction, it is not unusual to have it drawn to a size designated by so many thousandths of an inch, but dealers are required to keep a certain stock of standard sizes, and it is for the interest of manufacturers to have a uniformity of usage as to what shall be meant when a certain size of wire or thickness of plate are called for. We have not, in this country, had so much confusion, from the use of different gauges, as has been experienced in England, where, under what is known as the "Birmingham wire gauge," more than a dozen different scales of numbers are used to arbitrarily designate different sizes of wire, from those about half an inch in diameter down to the finest wires drawn. There is a pretty close agreement between several of these gauges for most of the numbers, but no one is acknowledged as a standard, and, unless the actual size as well as the number is given when ordering wire, mistakes and misunderstandings frequently occur. What the manufacturer may furnish as one number the dealer may, by using another scale, sell as quite a different size, and, in times of active competition, the opportunities to do this are frequent.

The present system of designating the sizes of wire by numbers has grown up with and been modified according to the development of the manufacture. What is known as No. 1 is supposed to have been originally so designated as representing the wire made from the first passing of the rough metal through the draw plate, with such facilities as were in use before steam power was employed in wire making. Nos. 2 and 3, and the following sizes, were each proportionately smaller, according to the results obtained by using similar means in drawing the wire down, the higher numbers representing constantly diminishing sizes. To designate thicknesses larger than No. 1, one or more ciphers are now used, according to the increased diameter. By this system the different sizes varied from each other irregularly, both in diameter and in weight of metal, but the trade had become so large, and the common sizes so well known by their numbers among mechanics and dealers, before any determined effort was made to introduce a uniform standard scale, that the task is now one of more than ordinary difficulty.

At a recent meeting of the Society of Telegraph Engineers, London, England, the differences between well-known wire gauges was made the subject of an elaborate report by a committee which had been appointed especially for that purpose. It was shown that there was an urgent necessity for some standard, and that the gauge, to be adopted should not vary materially from the present gauges principally used, which were "based on long practical experience, had become thoroughly rooted in technical language, and were well adapted to the practical requirements of trade." All of the principal gauges were referred to, and tables given showing the sizes, with percentage of reduction in weight and differences in size for the various numbers. Two general classes were made: empirical gauges or those in which the gradations between the respective sizes were formed by arbitrary differences; and geometrical gauges, in which the various sizes were fixed by perfectly uniform decrements of weight from size to size. The "Stubs" gauge, which is used to a considerable extent in this country, is one of the former. The committee say that, though very irregular in many of its gradations, it has been distributed in large quantities throughout the world, and "may perhaps be considered the most authoritative gauge in common use." Of the geometrical gauges, that made by Brown & Sharpe, which is called the "American" gauge, is spoken of as in all respects excellent, except that the greatest inconvenience would arise from its introduction, because the sizes are so much smaller than those of the Birmingham gauge. The Brown & Sharpe gauge starts with 0·46 of an inch as No. 0000; then multiply each diameter by 0·890523 (or deduct 10·9478 per cent) to form the next succeeding size, the numbers varying regularly in size and weight, and, of course, in electrical conductivity. As being preferable to this gauge, however, because the sizes more nearly approach those of the ordinary Birmingham scale, the committee recommend the Clark gauge, in which the intervals are so arranged that each size is exactly 20 per cent less in weight than the preceding one. By this scale the diameter diminishes by 10·557 per cent for each number as the sizes grow smaller, or increases by 11·803 per cent as they are enlarged; and, as with all geometrical gauges, a person knowing the size of one number can readily calculate that of any other. A sufficient number of intermediate sizes to fill all requirements for general use can be made by using half and quarter sizes, the thickness of which can be determined with precision. The committee strongly recommend this gauge for general adoption, as, beside, giving all the advantages of a geometrical scale, all the principal sizes in use conform very closely to its gradations, except in the lowest and highest numbers. It is as follows, the sizes being given in decimals of an inch:

No. of gauge.	Decimals of inch.	No. of gauge.	Decimals of inch.	No. of gauge.	Decimals of inch.
000	·492 1	10	·129	22	·033 8
00	·440 2	11	·115 4	23	·030 2
0	·393 7	12	·103 2	24	·027 1
1	·352 2	13	·092 3	25	·024 2
2	·315	14	·082 6	26	·021 6
3	·281 7	15	·073 9	27	·019 4
4	·252	16	·066 1	28	·017 3
5	·225 4	17	·059 1	29	·015 5
6	·201 6	18	·052 9	30	·013 9
7	·180 3	19	·047 3	31	·012 4
8	·161 3	20	·042 3	32	·011 1
9	·144 2	21	·037 8		

Although we have not experienced the trouble from the use of a multiplicity of gauges which has been felt by foreign manufacturers, there can be no doubt that, if we are ever to have any export trade in manufactures of metal goods, the general adoption of some geometrical standard, which would be known and acknowledged in all parts of the world, would be of great advantage. We have such a standard for American use in the gauge now largely used here, but with this is used also the "Stubs" gauge, and what is called "the old English;" and, between them all, mechanics and engineers are constantly giving orders for specific sizes, measuring by the thousandth part of an inch, as they would not feel called upon to do if there was a recognized standard of properly graded sizes.

THE FRACTURE OF THE DUILIO'S 100-TON GUN.

Following hard upon the bursting of the Thunderer's 38-ton gun and the experimental destruction of its companion to discover the secret of that disaster, there comes a still more remarkable failure of one of the largest guns ever constructed. During a series of experiments with the 100-ton Armstrong guns of the Italian ironclad Duilio, March 6, to test, not the guns, for they were considered as beyond suspicion, but the smooth working of the accessory machinery, one of the guns gave way in a manner altogether novel and unexpected.

The Armstrong guns, as our readers are all doubtless aware, are built up by the shrinking of a dozen or more massive coils of wrought iron upon a steel tube forming the bore. These coils overlap, and are designed to resist the circumferential strain of the exploding charge. The need of anything more than the friction of the coils upon each other and the tensile strength of the inner steel tube, to resist the longitudinal strain, does not seem to have entered into the maker's calculations. And just here is where the system failed. It was found after the disaster, in which several men were more or less seriously injured, that the gun had not burst, in the ordinary acceptation of the term: the interior steel tube had been entirely fractured across at the point where the enlarged powder chamber begins to slope toward the lesser part of the bore—the shoulder of the powder chamber, as it may be called. The rest of the gun, composed of various tubes made of coiled wrought iron, had simply disengaged itself as a glass stopper might be drawn out of a bottle, and the tubes were not broken in the slightest degree. Each one appeared to be as sound as

when it had been shrunk on to its fellows. The whole of the muzzle, together with the trunnions and the coils immediately behind the trunnions, even including the inner one which surrounds the steel tube, remained fixed by the trunnions to the carriage. The only movement of this mass had been the depression of the muzzle. The rest of the gun, including the whole of the breech, containing the rear part of the steel tube, from the shoulder of the powder chamber backwards, had separated itself from the muzzle portion, and, being unsupported, had yielded to the force of the discharged powder and been dashed backwards against the wall of the turret, displacing two of the plates, cracking the steel lining like a mirror, and crushing the heavy wooden backing through the gap made between the two plates.

The gun had been loaded by hand with a battering charge of 550 pounds of Fossano powder and a 2,000 pound projectile. It is claimed in favor of the gun that it was not originally designed to be chambered, nor to fire charges of 550 lb. with a velocity of 1,700 feet. The contract was fulfilled when 440 lb. of English pebble powder gave an initial velocity of 1,585 feet, with a total energy to shot of 34,840 tons, which gives 627 foot tons per inch of circumference, with a pressure upon the interior of the gun not exceeding 17 tons per square inch. The charge which created the destructive effect almost entirely filled the chamber and left practically no air space. Besides it developed a total energy of 40,000 foot tons, an energy of 720 foot tons per inch of circumference, and an interior strain of 20 tons per square inch. This the gun proved unable to withstand. The friends of the gun claim that its failure under these conditions argues no inherent defect in the system, and that there will be no difficulty in adding to the longitudinal strength of the guns to any extent that may be desired. Nevertheless public confidence in the system has been seriously broken, and the indications are that this most popular British mode of building great guns will have to be entirely reconsidered.

A REMARKABLE OIL COMPANY.

In many respects the Columbia Oil Company of Pittsburg is unique, and its career a remarkable one. The common lot of oil (petroleum) companies is to "bust," to involve stockholders in ruin, and to go into dividendless oblivion. To these rules the Columbia is a marked exception. For nearly twenty years it has produced petroleum, and today its territory adds over 400 barrels to the daily yield of the oil regions. Since the organization of the company in 1861 its properties have produced 2,748,820 barrels of crude petroleum, of 42 gallons each. During the same period the price of oil has ranged from $18 per barrel in July, 1864, to 65 cents per barrel in June, 1879. During its existence the company has declared and paid dividends to the amount of nearly four million dollars ($3,980,100), and the selling price of its stock (par $50) has ranged from $105 per share all the way down to $4·75 per share. The original shares numbered 10,000, but in 1864 were "watered" to 50,000 shares, making wealthy men of the "ground floor" stockholders. The oil-producing territory of the company comprises a number of farms in Venango, Butler, and McKean counties, Pennsylvania, but by far the most productive tract is the "Story Farm," located on Oil Creek, six miles from Oil City, Pa. In fact it is very doubtful whether a tract of the same area in the known world has been compelled artificially to yield so enormous a quantity of oil. The Story Farm comprises 600 acres, but the oil-producing portion of the tract is less than 100 acres. From this tract has been produced, up to April 1, 1880, 2,226,995 barrels of petroleum, and at present there is still 60 barrels per day coaxed out of this farm. This is done in a thoroughly systematic way, a single engine by means of "sucker rod" connections, pumping seven wells at once, thus reducing the outlay for wages to a minimum. A singular well was developed upon this farm some years ago, and its irreverent activity fully earned its title of the "Sunday Well." For months this well would flow only upon the first day of the week, refusing to respond to any known processes for inducing it to produce on week days. The headquarters of this veteran oil company are at Pittsburg, but the stock is held in New York, Philadelphia, and St. Louis. The last dividend was declared April 10, 1878, the low price of oil compelling this action.

THE GREAT GAS WELL OF PENNSYLVANIA.

Since the appearance of the article in these columns regarding the great gas well at Murraysville, Pa., and the carbon black works in process of construction, the owners of the well have been overwhelmed with letters from all portions of the country. These were mainly letters of inquiry from parties possessing similar wells, and indicate a widespread interest in the matter of the utilization of the vast storehouses of fuel tapped by the drill in various portions of the country. Recent tests of the Murraysville stream of gas indicated a pressure of 150 lb. per square inch as shown by a steam gauge. The test was necessarily imperfect and brief, inasmuch as the pipes showed signs of bursting. Owing to unforeseen delays, the carbon black works have only just commenced operations.

A Bewitched Telegraph Wire.

Mr. Siemens states that when he was engaged on the line of the Indo-European Company between Djulfa and Tabreez he found it necessary to intimidate the natives, who rather fancied the wire for various purposes. He was able to do this in a very effectual manner, for having found that at that time of the year there was a thunder storm nearly every afternoon, during which the line, being insulated, was charged by induction, he brought about a gathering of the natives and persuaded one of their notables to ascend a ladder and touch the wire, saying the wire would defend itself. On doing so, the man received such a shock that he fell down the ladder, and the wire was considered after that by the natives as being bewitched.

AMENDING THE PATENT LAW.

The raid upon our whole patent system, as it can only be properly characterized, which the proposed new law, referred to in our issue of March 6, promised to effect, seems now to be virtually defeated. There is no absolute safety against hasty and ill-considered legislation, it is true, so long as the matter remains in its present shape, but an effectual check has been put upon the operations of the would-be raiders. The exhaustive arguments presented to the Senate Patent Committee relative to the bill, with the amendments proposed by the members of the committee themselves, utterly destroy its force for the special end which was said to be the object of its promoters, and render it certain that the bill, if reported at all, will be so changed that its authors would not know it. It was conceded that the bill, as it passed the House, would be plainly unconstitutional, according to decisions already made by the United States Supreme Court; that it required a departure from all the fixed principles of jurisprudence; and, while the principal object or the ostensible plea made for its passage was, that it afforded the only way of stopping what were claimed to be unjust collections on account of the driven-well patent, it would have an equally disastrous effect upon thousands of other patents. One Senator asked why the bill should not, with equal justice, be made to apply to copyright cases, and it was apparent that there was no reason why it should not as well as to all other causes of action, as an effective way to stop vexatious litigation; because it not only deprived the plaintiff of any remedy, but actually put it in the power of the defendant to punish the plaintiff, where, on the merits of the case, the latter had been sustained.

Although influential supporters, and a certain number of votes in both Houses, can always be had for any measure which proposes to give infringers of patents a wider latitude, it is plain that the opposition to the driven-well patent at the West furnished the principal means by which this measure was passed through the House. This patent was obtained in 1866, after having been put in interference with two others for the same purpose; it was sustained by the Commissioner of Patents, and by the Supreme Court of the District of Columbia, but the controversy here gave the first opportunities for misrepresentation as to the validity of the patent, and, very soon afterward, driven wells began to be put down by parties not having the authorization of the patent which had been declared valid. It was not until 1871 that, in the hands of parties financially strong, earnest efforts were made to vindicate the rights of the patentee, and then a suit was commenced for this purpose which did not come to a decision till April, 1876, the testimony alone covering 2,800 printed pages, and the arguments being very exhaustive. During all this time the owners of the patent did not ask any royalty from users of the well, and, had the decision been against them, never could have collected anything. Upon getting a decision in their favor they immediately commenced to collect, but were met by such opposition that two more suits were necessary, one in Minnesota and one in Indiana, in both of which the patent was sustained. And now we come to the point which has given rise to all the excitement about the matter. The patentees gave notice that they wanted ten dollars from each unauthorized user of a driven well, but would make a deduction of one-half for all who voluntarily paid within twenty days.

Suits were commenced against those who did not, the Minnesota lawyers having at one time over four hundred suits commenced, and in these cases they made the royalty *and costs* come to $46.50 in each suit. The patentees did not receive any more than their royalty, but the case was one in which the lawyers had an opportunity for fine pickings, and the public was justly incensed. After a good deal of delay and trouble the patentees were enabled to place their business in different hands, so the costs might be made more moderate, but the excitement had commenced, and, it being found that no relief can be had through the courts, the patent having been everywhere sustained, a rush was made to obtain favorable legislation by Congress. The feeling in many quarters was, perhaps, something like that against the Chinamen in San Francisco, when the populace demanded the abrogation of a national treaty and the passage of laws that were unconstitutional, because they declared "the Chinese must go," but, unjust and oppressive as the collection of such costs were in these cases, it is not likely that the agitation against patents will be any more successful than was that against the Chinamen.

What was really aimed at was to get rid of the enormous costs of the law suits, to regulate a mode of practice, but it will not do to strike down the patentee for this purpose. As was said before the Senate Committee "Like any system of law, it will cause occasional inconvenience and occasional hardships in particular cases; like every system of law it will sometimes be badly administered. The question at the bottom of all propositions for amendment is, whether we shall amend it so as to cut off the evils, at the same time preserving its substance, its purpose, and its spirit, or whether we should cut off any evil that we find to exist, any annoyance or inconvenience that arises under it, without regard to whether such change virtually destroys the life of the system or not." The patent law undoubtedly has its defects, but if we cannot remedy them without destroying its life we must submit, Western farmers as well as other men.

SOME ELECTRICAL MEASUREMENTS OF ONE OF MR. EDISON'S HORSESHOE LAMPS.

BY HENRY MORTON, PH.D., A. M. MAYER, PH.D., AND B. F. THOMAS, AT THE STEVENS INSTITUTE OF TECHNOLOGY.

(Additions and corrections to article on page 241.)

In reading the above named article in print we notice some errors which require correction and some points calling for a more full explanation.

In the second column, ninth line from top, it is said that the *loss* of weight in one of the electrodes was 1·0624 grammes.

This was, in fact, the amount *gained* by the cathode, the loss of the anode being a trifle greater. The gain of weight was, of course, what it was intended to take, so that the error was only in the expression, and not in the process or result.

In the next place, in the foot note at the end of the same column, it is simply stated that the average of the maximum and minimum lights in azimuths at right angles and in the plane of the loop was taken as the average luminous power of the lamp. Our reason for this, however, was not mentioned, but was, in fact, that we found by measuring the light at every azimuth varying by ten degrees between 0° and 180°, that this was approximately the true expression for the total amount of light emitted. We see from the article of Profs. Rowland and Barker, in the *American Journal of Science*, that they, assuming certain conditions and discussing the same in a mathematical manner, have reached a different result; but as experiment shows this result not to be attained in fact, it is evident that the assumptions on which the mathematical reasoning is based do not include all the conditions present in the experiment.

Two other sets of experiments, made since those given in our paper of April 17, in which the candle power of the loop was in its best position, 17·6 and 19·8 candles, corresponding to averages of 11·7 and 13·2 candles respectively, showed a consumption of energy of 0·104 and 0·109 horse power per lamp, or 9·6 and 9·1 lamps per horse power. This would give 112 candles and 120 candles respectively per horse power of electric energy consumed or transformed in the lamp. These results certainly agree very closely with each other and with our former determinations.

The Philadelphia Wool Exhibition.

The International Exhibition of sheep wool and wool products, under the auspices of the Pennsylvania State Agricultural Society, will be held in the Permanent Exhibition Building, Fairmount Park, in September next. It is said by the officers of the society that the money realized at the fair held last year will enable them to offer unusual premiums for all classes of stock and machinery. Replies to circulars and letters addressed to prominent stock growers throughout the country already indicate that the exhibits will be so numerous that it will be difficult to accommodate them all, unless the exhibits already in the building are packed close together. The aggregate of prizes to be offered is $40,000, including $8,500 for cattle, $7,000 for horses (racing prohibited), $6,500 for sheep, $3,000 for swine, $1,500 for poultry, $2,500 for the dairy, $4,000 for tools, implements, and machinery, $3,000 for State, county, club, and individual exhibits of farm, orchard, and garden products, and $4,000 for wool and wool products and other manufactured goods. The sheep prizes are, for flocks $450 and $250, and for ram and five of his get, $250, $200, etc. No officers or members of the State society will be appointed for service on the juries of award.

Heavy Patent Damages.

In the United States Court, Rutland, Vt., Judge Wheeler granted a decree giving judgment for the plaintiff for $161,011.71, in the suit of Riley and Burdett against J. Estey & Co., organ manufacturers of Brattleboro. This action was originally brought several years ago to recover for the alleged infringement of a patent in the manufacture of organs. It was heard before the late Judge Johnson, but his death occurring before a decision was given, necessitated a reargument. This was had before Judges Blatchford and Wheeler, who found for the plaintiff and referred the case to ex-Governor Stewart, of Middlebury, with directions to compute the amount due. Governor Stewart reported in favor of awarding Mr. Burdett $149,039, to which Judge Wheeler has added interest from December 4, 1878, making the total judgment over $160,000. The defendants will appeal to the Supreme Court.—*N. Y. Sun.*

Progress in Walking Matches.

It is but a few years since 500 miles were considered a great achievement in six-day walking matches. When the limit was pushed to 550 miles, it was thought that the extreme verge of human endurance had been reached. That distance was exceeded by a fraction over fifteen miles by Hart, in the recent contest in this city; and it is not a wild prediction to say that an average of one hundred miles a day for six days will soon be made; probably by some swift and enduring walker, who will not be allowed to exceed 100 miles in any one day.

Delicate Test for Albumen.

To Mr. Siebold belongs the credit of having introduced a modification of the heat test, which is adequate to the detection of albumen under conditions in which its presence might be completely overlooked. The following is the author's own account of the manner in which the test is to be applied:

"Add solution of ammonia to the urine until just perceptibly alkaline; filter, and add diluted acetic acid very cautiously until the urine acquires a faint acid reaction, avoiding the use of a single drop more than required. Now place equal quantities of this mixture into two test tubes of equal size, heat one of them to ebullition, and compare it with the cold sample contained in the other test tube. The least turbidity is thus distinctly observed, and gives absolute proof of the presence of albumen."

A NEW WAREHOUSE TRUCK.

We give an engraving representing an improved truck for mills, warehouses, railroad depots, etc., recently patented by Mr. Montgomery A. Reynolds, of Stanton, Mich. The truck frame is mounted on two large wheels turning on an axle located a little behind the middle of the truck, and is supported in front by two caster wheels whose pintles turn in a stout iron frame hung from a crosspiece attached to the under side of the truck frame near the forward end. A handle is attached to the forward end by means of two strong iron arms.

The platform is provided with side boards and end boards, which may be used or not as occasion requires. Each end board has along its upper edge an iron rod which is bent downward at the ends so that when the end boards are in place the end of the rods may be turned down over the side boards and thus prevent them from being pressed outward when the truck is loaded. The truck, as its appearance indicates, is strongly built and intended to do good service wherever an article of this kind is required.

We are informed that these trucks will be exhibited at the Millers' Exhibition to be held in Cincinnati, Ohio, early in June.

A NEW VENTILATOR.

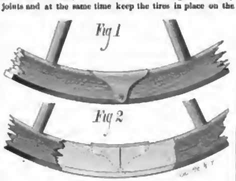
The accompanying engraving represents an automatic house ventilator recently patented in the United States and Canada by Mr. Walter S. Sayers, of Guelph, Ontario, Canada. This invention is intended to overcome in the simplest and most effective manner all of the difficulties which have stood in the way of ventilating from the top of windows without draughts of air on the occupants of the apartments. This ventilator is independent of either sash, and does not interfere with lowering or raising them, it does away with the necessity of hanging them with weights for the purposes of ventilation, and does not in any way interfere with hanging the curtains in the usual way. The ventilator is completely hidden from view in the interior of the room by the curtains or lambrequins, and on the exterior of the building it presents the appearance of a neat Venetian blind above the sash, and is an embellishment rather than other wise.

For windows in public buildings, offices, etc., where curtains are not used, the ventilator affords a good ground for stucco designs or other ornamental work. This ventilator admits pure air into the room without draughts; the air entering the room at the top of the window is directed by the air duct toward the ceiling, where it is distributed, displacing the vitiated air, which escapes by the ventilator. It is entirely automatic and requires no attention; the wind, on reaching a certain velocity, closes the pivoted guards, C, and prevents very strong currents of air from entering. The guards also exclude dust, and when the pressure of the wind diminishes the guards swing open automatically. If at any time it is desired to close the ventilator—and this will happen very seldom—it may be done by closing the valve, B, which is worked by a cord hanging down at the middle of the window. The valve opens by its own weight, when the cord is released. To prevent the entrance of flies and insects a netting is placed over the cornice board, A.

This ventilator can be used in connection with Venetian blinds or winter sash, as it does not in any way interfere with them. The inventor informs us that he has had this ventilator in use in his own residence for the last eight months, giving the most complete satisfaction. He also states that it is indorsed in the highest terms by physicians who have seen it. Further information in regard to this useful invention may be obtained by addressing the inventor and patentee.

IMPROVED FELLY PLATE.

The annexed engraving shows an improved attachment for vehicle wheels, which is intended to strengthen the felly joints and at the same time keep the tires in place on the wheels.



CREMER'S FELLY PLATE.

The device is exceedingly simple, being nothing more than a curved plate fitted to the rounded portion of the felly over the joint and held in place by a single bolt passing through the joint near the tire. The extreme ends of the plate project over the edges of the tire and prevent it from running off should the wheel shrink.

REYNOLDS' IMPROVED TRUCK.

Fig. 1 shows a portion of a wheel with the felly plate applied, and Fig. 2 is a sectional view of a felly taken through the joint, showing the position of the plate in dotted lines.

Further particulars in relation to this invention may be obtained by addressing the inventor, Mr. Charles Cremer, Cosumne, Cal.

Boracic Acid in Eye Diseases.

Dr. Saml. Theobald calls the attention of the profession, in the *Medical Record*, to the astonishingly favorable results which he has obtained from the use of boracic acid in the treatment of various affections of the eye; and, from these results, he feels constrained to say that this remedy must, ere long, obtain a position in ophthalmic therapeutics second only to that of atropia. Biborate of soda (borax), as well known, has long entered as an ingredient in popular remedies for the eye; and the use of boracic acid itself is not by any means as new as Dr. Theobald seems to suppose. It does no harm, however, to occasionally call attention to the value of old remedies, and which might otherwise be overlooked or forgotten.

Butter and Cheese by Machinery.

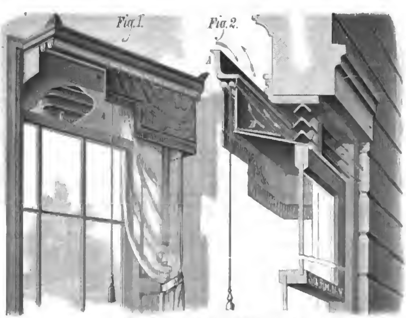
In our last issue we gave considerable space to the illustrations and description of the manufacture of oleomargarine. We now publish from a correspondent of the Philadelphia *Ledger* an account of the process of making butter and cheese on a large scale from fresh milk:

"The milk is brought to the creameries in the morning, and after being weighed, is run into long vats to undergo the process of raising the cream. In the center of these vats is a pipe about three inches in diameter, and in which are smaller pipes, through which cold water is forced by steam power, thus keeping the milk cold, and causing all the cream in the milk to rise to the surface in from three to four hours' time. The milk is then drawn from the vat, leaving the cream behind. The cream is then placed in churns, each holding about one hundred gallons, which are moved by steam power until the butter is formed, the time required being about thirty minutes. The churns have only two revolving wings, instead of four, as used in the ordinary hand churn. The churn is not moved at any greater speed than in the old process, but a regular and uniform motion is kept up until the work of bringing the butter is completed. The butter, after being removed from the churns, is placed upon tables and worked by hand, a round bar being used. The work can be done by machinery, but in most of the creameries the process by hand is preferred. The skimmed milk is taken to the cheese department and placed in large tin vats, and hot water, instead of cold, is forced through the milk in which rennet has been placed to make it curdle. When this process is completed, the product is put in boxes holding thirty-five pounds, and pressed. It is then stored for about thirty days, when it is ready to be sold in the market as cheese.

"The first creamery in the State, it is said, was started less than a year ago at Quakertown, Bucks County, and now some fifteen of them, and more new ones are talked of. The establishments are generally owned by companies, the capital required to start one of the capacity of 4,000 quarts daily being from $4,000 to $6,000. What effect these establishments will have upon the supply of milk to consumers in large cities, or its price to them, has yet to be seen. At all events, the experiment of making butter and cheese by the processes described above is fully under way, and it will not take long for the parties interested to ascertain how much profit there is in it. At present, the great want in the establishments is milk enough to run them to their full capacity, but this want, no doubt, will be met as the farmers gain a knowledge of the demand."

Paper Leather.

The *Paper World* describes a new kind of paper sizing which promises to be exceedingly useful. It is considerably cheaper than ordinary size, and it has the merit of making the paper waterproof without discoloration. In one experiment one hundred and eighty-five pounds of leather board were manufactured from hemp, which was made nearly fine in the engine, and then the new sizing added, mixed, precipitated, and beaten fine. The thin, endless sheets were woven around a cold cylinder, and when of sufficient thickness, cut, removed, and dried in the sun. Strips one-fourth of an inch thick, when dry and before rolling, were as pliant as most sole leather, and could be bent square over without cracking. This leather board can be made insoluble in either hot or cold water. A piece of it not perfected, and not wholly impervious to water, one-fourth of an inch wide, cut lengthwise of the fiber, held up seventy-seven pounds stone. By rendering the same board insoluble, the strength was increased from seventy-seven to two hundred and eleven pounds. Leather paper of less thickness, made in the same manner, is described as pliable, somewhat elastic, apparently durable, and suitable for the uppers of shoes.



SAYERS' AUTOMATIC VENTILATOR.

ONE of the cars of the Edinburgh and Glasgow Railway which fell from the Tay Bridge, was picked up several weeks after the disaster by fishermen on the western coast of Norway.

Hardening Small Tools.

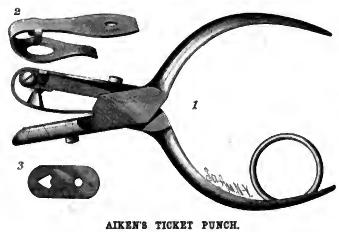
It is said that the engravers and watchmakers of Germany harden their tools in sealing wax. The tool is heated to whiteness, and plunged into the wax, withdrawn after an instant and plunged in again, the process being repeated until the steel is too cold to enter the wax. The steel is said to become, after this process, almost as hard as the diamond, and when touched with a little oil or turpentine the tools are excellent for engraving, and also for piercing the hardest metals.

NEW TICKET OR CANCELING PUNCH.

The superiority of this punch over others consists in the manner in which the dies are inserted in the punch and the interchangeability of the various parts, as illustrated in the accompanying engraving. Canceling punches are usually made with one or both dies cut out of the jaw of the punch itself, thereby necessitating the purchase of a new punch when the dies become worn, or a change in the die is required. In the punch illustrated the dies can be easily and cheaply repaired, or changed to a different design.

The uses to which the canceling punch can be applied are already very large and daily increasing. There are over three thousand railways in the United States, all using some sort of a canceling punch. Banks, counting-houses, grocers, eating houses, and all branches of trade in which canceling punches can be used to advantage, are adopting them.

All the detachable parts of the "Aiken ticket punch" are made of the finest cast steel and carefully tempered, thereby guaranteeing the longest wear that is possible to be obtained. The punches are highly finished and nickel plated. Many of the first railroads in the country have adopted them, and we are informed that all without exception pronounce them to be the best punch in use. Further information may be obtained from the patentee, Mr. J. B. Aiken, Franklin, N. H.



AIKEN'S TICKET PUNCH.

Consolation for the Bald.

Professor Fournier, in a lecture on alopecia, says of baldness: "There is nothing ridiculous or malformed about it, and it confers upon the physiognomy an expression of wisdom, experience, and venerability. It adapts itself marvelously to certain heads which would be deformed by a wig, and is the severe beauty represented in sculpture by the classic head of Æschylus."

NEW HOSE CARRIAGE.

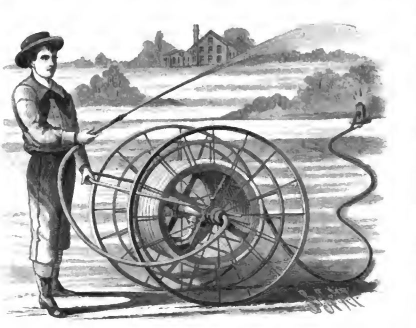
Any one fortunate enough to possess extensive grounds knows only too well the difficulties of keeping the lawns and gardens in prime condition; one of the principal troubles experienced is that of properly irrigating the grounds. The device shown in the annexed engraving fills a need that has been long felt, and supplies a means of watering grounds thoroughly and conveniently.

The novel feature of this carriage is the arrangement by which water is conveyed through the hose connected with the hydrant to the hollow axle of the carriage, and the manner in which it is distributed by means of the short service pipe held in the hand.

The reel on which the hose is wound is secured to the hollow axle of the hose carriage, and when the reel is revolved in winding up or unwinding the hose, the hollow axle turns in the hubs of the hose carriage wheels. The inner end of the hose is connected with a nipple projecting from the hollow axle. The outer end of the hose is provided with a union or coupling for connecting it with a hydrant from which the water is taken. The water passes through the hose as it is wound upon the reel, thence to the hollow axle, and out through the service pipe. The latter is connected with the axle by a swivel joint, so that the turning of the axle does not affect the service pipe. By taking the handle of the hose carriage in one hand and the service pipe in the other, one may walk along watering flowers, plants, or grass, on either side, as far as the force of the water will carry the spray. In this way one section after another may be watered without difficulty. The inventor informs us that a child ten years old is capable of using one of these carriages and taking the entire charge of it. The hose carriage has been thoroughly and practically tested, and has proved itself a complete success. A carriage of the size illustrated will hold 400 feet of three-quarter inch hose, or 300 feet of one inch hose; with these lengths a plat from 600 to 800 feet in diameter may be irrigated without disconnecting the hose from the hydrant.

Where this hose carriage is adopted dragging the hose is entirely avoided, and the hose never kinks, but is always laid smoothly, and may be taken up very easily without the usual wear and tear of the usual methods of handling.

The wheels of the hose carriage are 36 inches in diameter. The reel wheels are made somewhat smaller, so that they will not touch the ground. The entire carriage is made of steel, iron, and brass, and is practically indestructible. They are made in various sizes to suit the requirements of different users. Further information may be obtained by addressing the inventor and patentee, Mr. J. B. Aiken, Franklin, N. H.


AIKEN'S NEW HOSE CARRIAGE.

A New Compound.

A new metallic compound, applicable to many artistic and industrial purposes, has been recently announced in England. The substance belongs to the class known as the thiates or sulphur sulphides. Nearly a year ago Mr. J. Berger Spence discovered that sulphides of metals combined with molten sulphur formed a liquid. This liquid on cooling became a solid homogeneous mass, possessing great tenacity, and having a peculiarly dark gray, almost black color. It has a comparatively low melting point, namely, 320° Fahr., or rather more than 100° above the temperature of boiling water. It would thus require only a small amount of fuel to reduce or to melt it. The new compound also expands on cooling—a property not shared by the majority of other metals or metallic compounds. For such purposes as joining gas or water pipes this expansion is of great importance. It is also claimed that the new compound resists favorably atmospheric or climatic influences, as compared with bronze or marble, and that its resistance to acids is much superior to that of other metals or metallic compounds. These qualities, if sustained by further experience, would certainly render the new compound very useful in many ways.

A California Tunnel.

The longest of the series of tunnels on the South Pacific Coast Railway, in the Santa Cruz mountains, California, has just been completely pierced. The tunnel, which is over a mile in length, was begun a little over two years ago. The presence of petroleum in the formation has resulted in several disastrous explosions, involving many delays and considerable loss of life.

A New Way of Heating Railway Carriages.

French railway cars are warmed by means of hot water bottles; that is to say, cases made of iron, about three feet long, six inches wide, and four inches thick, which are filled with hot water and put on the bottom of the car for passengers to place their feet upon.

It is reported from Lyons that the Compagnie Paris-Lyon-Méditerranée is now trying a new method of heating in express trains. The method was proposed by M. Ancelin, an engineer, and consists simply in the use of acetate of soda in the foot warmers. The substance has considerable latent heat; dissolving at a certain temperature, it thus absorbs a large quantity of heat, which becomes sensible during crystallization in cooling. All that is required is to fill the ordinary cases with a sufficient quantity of the acetate, close them, and place them in a stove at about 100°. The cooling of a case thus charged and heated takes twelve to fifteen hours. The warmers are thereafter taken from the compartments and placed in a stove (where the crystals of soda acetate are re-dissolved); they are then ready for fresh use. The advantages of such a system are obvious—no necessity of changing warmers every two or three hours, or of maintaining a numerous body of men at stations to attend to them; economy in cost of heating, etc. Moreover, most of the existing foot warmers can be utilized. Acetate of soda is not very expensive, and it could easily be manufactured in much larger quantities than at present if the demand required it. The new system has been tried on the express train No. 5, leaving Paris at 7:15 and reaching Perrache at 4:31. The compartments were each supplied at starting with two warmers containing acetate of soda. At Perrache most of the warmers were still so hot that one could not apply the back of the hand to them. From Lyons to Marseilles the train was heated on the ordinary system.

Charles T. Chester.

Charles T. Chester, inventor and electrician, died recently at his residence in Englewood, New Jersey, at the age of fifty-four. Mr. Chester was for a number of years engaged in the manufacture of electrical apparatus in this city. He is best known as the inventor of the fire-alarm telegraph and originator of the law-telegraph system. At the time of his death he was electrician to the National Electric Light Company.

Mycenæ.

With respect to Dr. Schliemann's discoveries at Mycenæ, the Russian *savant*, M. Stephani, has expressed opinions which have attracted considerable attention in Germany. The learned academician by no means disputes the great antiquity of many of the individual objects unearthed by Dr. Schliemann, but he holds that the remains include objects belonging to very different eras of history. He contends that the date of the tombs must be determined by the latest products of art or industry which have been discovered in them. The seal ring is especially important in this respect, as, according to his view, it is executed entirely in the style of the New Persian art. He is of opinion that the tombs originated with the barbarians who invaded Greece in the third century B. C., and made the citadel of Agamemnon one of the chief centers of their dominion. Here he believes they buried their chiefs, and decorated the tombs partly with such ancient relics of an earlier date as had fallen into their hands and partly with ornamental objects produced in their own times.

A Town Lighted by Electricity.

Wabash, Ind., boasts of being the first town to adopt the electric light for general illumination. A beginning was made March 31, with four Brush lamps of 3,000 candle power each suspended on the flagstaff of the court house. A seven horse-power generator supplied the electricity. The contract called for a light equal to a gas burner at a distance of 2,640 feet from the lamps. The tests were said to be satisfactory. Many visitors from adjoining towns were present to witness the first trial of the new method.

THE following is the way the newspapers in the mining regions talk to their readers:

"A man at Dutch Flat picked up a rock, the other day, to throw at a cow. The weight of it attracted his attention, and on examination it was found to contain over a hundred dollars in gold."

The Exodus from Europe.

The prophecy of the Commissioners of Emigration that the current year would see a marked increase in the number of immigrants arriving from Europe is being fulfilled with a liberality quite unexpected.

The total number of immigrants who came to this port in 1879 was 175,589, which was very largely in excess of preceding years, being 59,723 more than in 1878, which exceeded 1877 by 20,811. During January and February of 1879 the arrivals numbered 5,143, while for the first two months of this year the aggregate was 13,765, an increase of 8,622. These are invariably the two lightest months in the year. During March, 1879, the record shows 6,085, while for the month just closed this year the official figures are 21,090, an enormous increase of over 15,000. During the first quarter of the present year there was landed 34,855, against 11,052 in 1879. A heavier immigration is expected this summer than ever before. The new arrivals are chiefly Germans. Since the Commission was organized in May, 1847, Germany and Ireland have sent in about equal numbers, the total figures to the close of 1879 being, for Germany, 2,195,398, and for Ireland, 2,012,046. This year, during January and February, the proportions were—Germany, 3,577; Ireland, 2,397. A large immigration will undoubtedly come from Ireland on account of the famine, but it has not yet set in.

The applications for newly arrived laborers are largely in excess of the supply; and, curiously, the number of immigrants registered as seeking employment is smaller than it has ever been in recent years. With the exception of the Hungarian arrivals, nearly all have definite plans for the future. They have money and friends, and usually go West to situations procured in advance by their countrymen resident here. The demands for immigrant labor are mostly for Germans, Swedes, and Scotch; but Superintendent Jackson says that, among these nationalities, scarcely one in a hundred stops at New York to seek employment.

NEW BOX MACHINE.

We give herewith an engraving of an improved machine for cutting box blanks from a block of wood, and at the same time grooving them preparatory to bending them into forms for making the rectangular sides of a crate or box, as shown in the engraving.

Fig. 1 is a perspective view of the complete machine, showing also the bed plate and knife detached. Fig. 2 is a vertical section taken through the block-holding and cutting mechanism.

In the wide end of the main frame of the machine is arranged a knife, D, with its edge inward. This knife is firmly secured to the solid bed frame, so that it will not be liable to bend under a heavy strain. In front of the knife there is a gauge plate, which is movable lengthwise, being adjusted in this direction by a screw.

This gauge plate supports the plate, D, which carries a series of cutters for forming transverse grooves in the box blanks. The gauge plate has a series of wedge-shaped projections on its upper surface, which correspond to a series of cavities in the under surface of the cutter plate, so that when the gauge plate is moved lengthwise by means of its adjusting screw, the cutter plate will be raised or lowered, as may be required, thus governing the thickness of the blank. The cutter plate is clamped firmly to the bed of the machine by two screws passing through slots in the gauge plate.

The cutter plate, B, is provided with the convex cutters for forming the transverse grooves in the box blanks, and also with inclined cutters for chamfering the ends of the blanks.

A traveling block-holder, A, moves over the bed of the machine and carries the block from which the box blanks are cut, back and forth over the knives in the bed, cutting at each forward movement a blank suitable for making a box like that above described. The block is held in place by a clamp, *b*, attached to a weighted follower that continually presses the block downward and feeds it automatically to the knives.

Whenever it is desirable to raise the weighted follower, it is done by turning a small windlass, *a*, journaled in the block-holder, and provided with a ratchet for holding it when required. The proper reciprocating motion is given the block-holder, A, by means of cranks and connecting rods connected with opposite ends. A check or holder, C, pivoted in the lower portion of the bed, is made, by an ingenious cam arrangement, to rise at each cut and support the blank. The machine is entirely automatic after the block is put in.

The machines are strongly built, and turn out the blanks very rapidly. They are made in various sizes; the largest made up to this date are 56 inches in width, but they may be made much larger. The only limit to the size is the length of the knife. A 56-inch machine will cut blanks for boxes from 9 by 18 inches by 10½ wide down to the size of a match box.

This machine was recently patented by Mr. William Huey, of Cambridge, Md. Further information will be furnished by Mr. J. D. Richards, Box 43, Cambridge, Md.

Fig.1

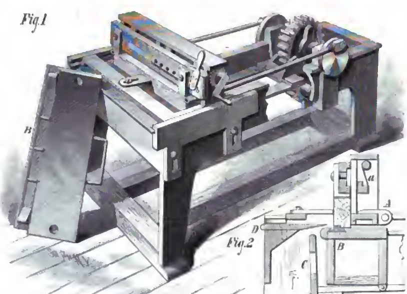


Fig.2

HUEY'S BOX MACHINE.

NEW EGG CARRIER AND CRATE.

The engraving represents a novel egg crate and carrier recently patented by Mr. William Huey, of Cambridge, Md. The blanks for the crate and for the carrier are both made on the machine shown on the lower part of this page. These blanks are sliced from a block of wood, and the transverse grooves which admit of making the boxes with bent joints at the corners, and with the adjoining ends lapped so as to form a strong yet perfectly smooth joint. Fig. 1 shows the egg crate and box with portions removed to show their construction, and Fig. 2 shows a box blank bent at the corners and about to be joined at the ends. In forming the box the inventor bends the shorter of the beveled ends inward until its outer side inclines to the angle of the cut on the other end. By this arrangement, if the parts are to be glued, the glue is not applied to the ends of the grain on both sides of the joint, and a strong joint is secured.

Fig.1.

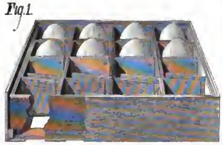


Fig.2.

HUEY'S EGG CARRIER AND CRATE.

The arrangement of cells shown in Fig. 1 is designed for transporting eggs and other fragile or perishable articles, and the device consists in a case formed with parallel partitions subdivided so as to form cells, by elastic wings secured on one side to the parallel partitions and overlapping their free ends to form expansible cells or pockets, for receiving and protecting the eggs.

The wings are formed of thin strips of wood made on the machine described below. The transverse groove formed in the blank renders the wood thin and springy at the joint.

The advantage of a crate of this character will be seen by shippers and producers of articles requiring carriers of this kind. It is inexpensive, durable, and effective.

Further information in regard to this useful invention may be obtained by addressing Mr. J. D. Richards, P. O. Box 43 Cambridge, Md.

The Manufacture of Dynamite.

The industrial production of nitro-glycerine, the base of dynamite, has been attended with no little danger, as many terrible accidents bear witness. Among the prizes recently awarded by the French Academy of Sciences is one of 2,500 francs to MM. Boutmy and Foucher, who, by introducing new modes of producing nitro-glycerine in large quantity, and by various precautions, have rendered the manufacture of dynamite much safer, so that in their works at Vonges no life has been lost during the last six years, and the general health has been excellent. In the old method, in which fuming nitric acid, or a mixture of this and sulphuric acid, is made to act on glycerine, and the mass is suddenly immersed in water, the reaction often produced heat sufficient to decompose a part of the nitro-glycerine, occasioning violent explosions (in spite of the refrigerating processes adopted). The principle of the new process consists in obviating the greater part of the heat by first engaging the glycerine in a combination with sulphuric acid, forming sulphoglyceric acid, and then destroying slowly, by means of nitric acid, the sulphoglyceric compound. Two liquors are prepared in advance—a sulphoglyceric and a sulphonitric (the latter with equal weights of sulphuric and nitric acid). These disengage a considerable amount of heat; they are allowed to cool, and are then combined in such proportions that the reaction takes place slowly. In the old method the nitroglycerine is separated almost instantaneously and rises in part to the surface, rendering washing difficult. In the new it forms in about 20 hours, and with a regularity which prevents danger. It also goes to the bottom of the vessel, and can be washed rapidly.

MECHANICAL INVENTIONS.

Mr. John H. Parkinson, of Virginia City, Nev., has patented improvements in air compressors especially adapted for use at mines. The object of the invention is to construct a simple and durable apparatus, which will occupy but small space and require but little power to drive it.

An improved axle box, patented by Mr. George W. Thomas, of Bear River, Nova Scotia, is applicable to carriage, wagon, car, and all other axles, and to all shafting. The invention consists in the combination with friction rolls of an axle box journaled in rings connected by diamond-shaped bars extending the whole length of box.

A novel and simple apparatus to be used in the process of making ice by the absorption or pumping of ammonia gas, has been patented by Mr. Andrew J. Zilker, of Austin, Texas. The invention consists of two or more sheets of galvanized iron or other metal set in a tank of fresh water, one on either side of the evaporation pipes, and held in a position parallel to each other by anchors or yokes that connect them.

An improved vise for holding circular saws while filing and upsetting their teeth has been patented by Mr. James L. Glover, of Windsor Locks, Conn. It is so constructed as to hold the saws firmly while being operated upon.

Mr. George E. Bigelow, of Geneva, Neb., has patented an improved water elevator which consists of a conical axle carrying a chain or rope to one end of which a weight is fastened, said axle supporting also a wheel or pulley which carries a chain or rope, one end of which is attached to the wheel and the other end to a bucket.

A metal bending tool for use of blacksmiths and others having occasion to form angular bends in metal bars or plates, a tool which will enable the work to be done much more easily, quickly, and economically than by the ordinary means, has been patented by Mr. Samuel Patterson, of Altoona, Pa.

Mr. William H. Hottel, of Woodstock, Va., has patented an improved alarm attachment for grist mills, designed to give a distinct alarm for indicating the irregularity of speed, whether in a mill or other class of machinery, which may be heard at any part of the mill, or which, by the aid of a telephone, may be heard at an office, residence, or other point remote from the machinery.

Messrs. Monroe Frank and Alfred Dickison, of Bowlusville, O., have invented an improved drag sawing machine, intended to be used by hand in sawing firewood. It is simple and well designed.

A stationary steam boiler, composed of hot water, steam, feed water, and air tubes laid horizontally, in coils or sections, one above another, in the order named, in a brick fire chamber, and having all the tube couplings and connections outside of the brick work, so that they may be readily got at for examination or repairs, and having also the steam and mud drums outside of the brick work, has been patented by Mr. Milton W. Hazelton, of Chicago, Ill.

AMERICAN INDUSTRIES.—No. 41.

THE BRASS MANUFACTURE.

This department of metal working has, for several years past, been showing a steady and most wonderful growth, as a consequence principally of improvements made in machinery. The great ductility and malleability of brass—the ease with which it can be rolled, drawn, and hammered when cold—render it possible to use with great advantage, in working it, all kinds of modern punching and draw presses, and it is now employed in the making of an almost endless variety of articles in which its use was formerly unknown, or so small as to be quite insignificant.

Ordinary commercial brass, as now generally made, consists of two parts by weight of copper and one of zinc, though the proportions vary according to the quality of the brass. Zinc is a good deal the cheaper of the two elements, but it melts more readily, and burns off to some extent in the fusion. Copper melts at 2,200° Fah., and zinc at 770° Fah. The best quality of brass is that known as "low brass," which has a greater proportion of copper than the "high brass," which is the cheaper grade. "Low brass" now sells at four cents a pound more than high brass. With still less copper, and proportionately cheaper, we have "yellow metal" for bottoming vessels, etc. The composition of the latter varies as much as does that of brass, the proportions being from thirty-seven parts zinc to sixty-three parts of copper to equal parts of each. What is known as "German silver" is made by melting nickel, one-sixth to one-third in amount by weight, with brass. A small percentage of lead is sometimes used in brass, diminishing its ductility and increasing its hardness, one to two per cent. rendering the brass capable of being readily worked on the lathe, or filed, without clogging the teeth of the file. A tough brass for engine work is composed of twenty parts of copper to three of zinc and three of tin, while for heavy bearings a brass is made of thirty-two parts of copper to one of zinc and five of tin. "Pinchbeck" has generally about four parts of copper to one of zinc, and a white metal largely used for cheap table furniture, etc., has ten parts of copper to eighty of zinc and ten of tin.

In our illustrations to-day we show the principal operations of the brass manufacture, as conducted in one of the oldest establishments of this kind in the country, and one of the largest in the world, that of the Benedict & Burnham Manufacturing Company, at Waterbury, Conn.

The "casting" is the first operation, as illustrated in the middle of the first page at the right hand side, where an interior view of the foundry is given. The foundry building is 50 by 100 feet in size, and across the middle, from side to side, runs a bank of small, low furnaces, twenty-one on each side, giving facilities for the melting of forty-two crucibles of metal at a time. The casting done here consists almost exclusively in the making of small slabs for rolling into sheet brass, flat bars for rolling and then drawing into wire, and hollow cylinders from which seamless tubing is made. Comparatively few articles are now cast in brass, as the metal can otherwise be worked with such facility that the old methods of manufacture are mostly done away with. The crucibles are of a size to hold from one hundred to one hundred and thirty pounds of metal each; in these are placed the desired proportions of copper and zinc, by weight, or of old metal or scrap, great care being taken to maintain the exact relative proportions of each, which requires close attention, as the zinc burns off rapidly at the heat required to melt the copper. The crucibles, when charged, are covered with charcoal and set in the furnaces, which are fitted with sliding plates to close the top, each furnace having an aperture at the back communicating with a tall stack, which carries off the volatile results of combustion and fumes of zinc. When the metal has been properly fused it is poured direct from these crucibles into the moulds, which are of iron, held together by clamps. The copper used is principally from the Lake Superior ore. The company have a high reputation for the excellent quality of their metals, as their long experience in the business has enabled them to overcome many difficulties which formerly existed in making just the desired combinations. They have some workmen in this branch of the business who have been in their employ upward of a third of a century.

The large illustration across the top of the page shows the department where both the slabs for sheet brass and the flat bars for wire are rolled. The first operation here is to trim off the edge left rough from the mouth of the mould, and for this purpose immense shears are used, the working arm of one pair of which will weigh as much as a ton; this is worked with a powerful leverage, so that the thick bars and slabs of brass are trimmed off as easily therewith as a paper doll would be cut out with ordinary scissors. The huge rollers, arranged in gangs, are of different sizes, sixteen pairs being in operation. They work in iron frames of the greatest solidity, the motion being given by a loose or flexible joint, to admit of the upper roller being set at varying heights for the different thicknesses to which the brass is to be rolled. In some of the rolling one hundred and fifty horse power is at times required to drive a single pair of rollers, and, strongly as they are built, they sometimes break under the great pressure they have to bear. Little streams of water are constantly pouring over them when in operation, and the first "squeeze" which the slab or bar of cast brass receives reduces its thickness by about a sixteenth of an inch, or rather more than is effected by each successive rolling thereafter. This operation, the metal being successively passed through the rollers, is continued, for sheet brass, until the plates are reduced sufficiently thin for any purpose desired, but the bars intended for wire are only rolled down to about half an inch thickness, the size from that point being diminished by the drawing.

The "annealing," as shown in the view on the left in the middle of the page, is conducted in six large ovens heated by wood. The fires are on each side of a space about five by eighteen feet, where the bars and slabs of metal are laid, after each successive rolling, until heated to a red heat, and thence drawn out to cool slowly in the air. The metal, by the compression of the rolling or drawing, becomes comparatively hard and brittle, but the annealing restores its former softness and pliability. Chestnut wood is used for heating the annealing ovens, some four thousand cords a year being consumed in this way. After each process of annealing the metal is subjected to a bath of dilute sulphuric acid, the acidity to the tongue being about equal to that of lemon juice, which removes the tarnish given by the heating.

The "overhauling" or scraping, as shown in the view in the middle of the page, is something of an "inspecting" operation for all roll and sheet brass. This is done only before the final rolling, and is intended to remove all spots or imperfections, so that the brass, as it comes from the rollers the last time, will be as nearly perfect as possible. A great portion of this work is done by hand, but our representation shows some machines for this purpose, in which small scrapers are guided by the hand of the operator to scratch over and clean the surface of the metal where necessary.

Wire drawing is shown in the large view at the bottom of the page. The bars, having been rolled until they are about six inches wide by eighteen or twenty feet long, and something less than half an inch thick, are passed between rollers with interlocking sharp edged ridges and grooves, by which the metal is cut into rough square rods. One end of each rod is then made slightly smaller, so that it may be put through a hole of the size to which the whole rod is to be drawn down. The draw plate is a thick plate of the finest steel, perforated with holes of the various sizes from that of the largest to the smallest wire required. The holes differ from each other by almost imperceptible gradations, and they are tapering or slightly conical in form. The end of the rod of metal, having been put through one of these holes, is seized by pincers operated by machinery, and pulled through far enough to be made fast to an iron cylinder or upright roller, turned by power from the main shafting. The wire is in this way drawn through a series of smaller and smaller holes until it is reduced to the required degree of fineness, the wire being coiled up on the roller as it is drawn out. What is known as the "old English gauge" is the one by which wire is generally sold, while sheet metal is usually graded according to the "American" scale. In the latter the sizes run smaller in most of the numbers than in the former. The sizes of the "American" scale are graded on a uniform variation from No. 0000, which is 0·46 of an inch in diameter, to No. 40, which is 0·003144 of an inch thick. Other sizes than these are made to order when required.

The large view on this page, showing where tin, brass, and copper tubing is made, illustrates an important branch of the business done at Waterbury. Seamless tubes are now being much more generally used than they formerly were, and their greater strength and durability are obvious. In the other kinds of tubes the sheet metal is cut into strips of the required width and passed through formers, which fold the metal over so the edges are just ready to make a joint, and then a seam is brazed. For the seamless tubing the metal is cast in the form of a cylinder, about five feet long, with a core, so as to leave an inside diameter of about four inches. These hollow cylinders are then put through one drawing machine after another till they are drawn down to the required size, a steel arbor forming the inside of the tube as the draw plate shapes and finishes the outside. For beaded and ornamented tubing, round, square, octagon, etc., the metal is passed through draws of the required shape, and in which the pattern is cut in wheels to act as dies. A great many boiler tubes are drawn at this establishment, but the work includes every variety known to the trade, from tubes having a 4½ inch inside diameter down to those of small wire with an inside aperture which the finest thread would fill.

The principal productions of the Benedict & Burnham Company are sheet and roll metal, and brass, copper, and German silver wire and tubing, but they make beyond this a great variety of other work. A large department is devoted to the manufacture of kerosene lamp fixtures, and here nearly all the work is done by punching and drawing presses. In this line of goods they export large quantities to every part of the globe. The establishment has, at different times, executed many large orders for the government. They regularly turn out rivets and burrs, chains, butts and hinges, drop handles and knobs, escutcheons and ornaments, etc., and have, since January 1, been making about 500 watches a day. This is a comparatively new branch of business with them, but their watch is made to sell at a very low price, and has met with so large a demand that they are now constructing additional machinery to enable them to greatly increase their production.

The State of Connecticut has been for many years "headquarters" in the brass manufacture, and the Benedict & Burnham Manufacturing Company dates from the very commencement of the business. The house was established in 1812 by Aaron Benedict, father of Mr. Charles Benedict, the present head of the company. In 1824 Mr. Benedict introduced the first machines ever used in this country for rolling brass; they were imported from England, the rollers being 11 inches in diameter by 30 inches long, and elicited no little comment at the time. With the aid of this machinery they were able at once to commence supplying all brass workers with sheet brass, and their business grew rapidly. In 1833 they began rolling German silver, to be manufactured into spoons, forks, etc., and from

BENEDICT & BURNHAM MANUFACTURING COMPANY.—BRASS MANUFACTURE.

that time to this their field of operations has been steadily enlarged. They now employ over 600 hands, and their buildings cover about six acres of ground. They have one 400 horse power engine, and two water wheels; for one of the latter they obtain the water from the Mad river, and for the other from the Naugatuck, their works being beautifully situated along the left bank of the latter, just below the entrance of the Mad. The present company was incorporated in 1843; but even the extensive business which it conducts hardly tells the full story of its success, for the company or its members have at different times started several other manufacturing industries, which are properly only offshoots, as it were, of the parent business, but which have now grown to be of large dimensions.

The company have stores at 78 Reade street, New York; 57 Oliver street, Boston, and 17 North Seventh street, Philadelphia. Mr. Charles Benedict is President and Treasurer of the company, and Mr. Charles Dickinson, Secretary.

A NOVEL SHADING PEN.

The annexed engraving represents a new instrument for plain and ornamental lettering, and is adapted to the use of bookkeepers, artists, markers, clerks, and penmen generally. The manipulation of the pen being purely mechanical and automatic, any person writing an ordinary hand can use it successfully and with satisfactory results. Its use familiarizes the eye with uniform design, so that the regular hand writing is rapidly improved. Shaded letters may be produced as readily as the plainest, and of such quality as to compare favorably with steel engraving or lithographic work. Several widths of this pen are made—one eighth, three sixteenths, and one fourth—each of which will make any width of line, from that of a hair line to the full width of the pen. They are made entirely plain throughout their entire width, or arranged to shade one side of the line produced according to the taste of the writer.

STOAKES' AUTOMATIC SHADING PEN.

These pens are inexpensive and must prove very useful in nearly every branch of business. Bookkeepers, with slight practice, can make ledger headings so uniform and artistic in appearance as to be quite beyond the comprehension of persons unfamiliar with the simple manner of their production. Any kind of ink may be used. The inventor informs us that more than seventy distinct and brilliant shades of color may be produced with the several colored inks adapted to this pen and in common use. The construction of the pen will be understood from the engravings, the larger view showing the pen in actual use, the smaller views showing the different sizes of pen.

Further particulars in regard to this useful invention may be obtained by addressing the patentee, Mr. J. W. Stoakes, Milan, Erie County, Ohio.

NEW WALL TENT AND STOVE.

A stove is often a necessity and always a desirable comfort in camp; for even in mid-summer there are chilly mornings and evenings and rainy days, when the comfort of a little heat in the tent is greatly to be desired. All who have had experience in camping know that the proverbially unmanageable stovepipe is most unmanageable in a tent. After ripping a hole in the tent, and getting the stovepipe in place, it is no uncommon experience to replace it again and again, after the wind has detached it from the stove and caused it to tumble; and should the pipe be permanently attached to the stove, the matter is made even worse, as not only the pipe but the stove also must sooner or later come down. These difficulties are not by any means all that can be brought as objections to the ordinary camp stove and its accessories. It is a cumbersome addition to the equipage, and takes up a great deal of valuable room in a tent where there is very little room to spare.

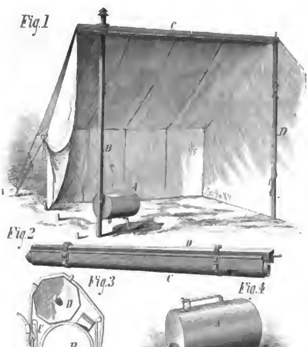
The Hobbs tent frame and stove overcome the difficulties enumerated, and afford a compact, light, and efficient cooking and heating apparatus, well adapted to the wants of military men, sportsmen, surveyors, and engineers, for camp meetings, pleasure camps, and for all who dwell in tents during a portion of the year. It is particularly well fitted for cooking, and its application to kitchen tents will not be among the least valuable of its uses.

The invention consists in substituting for the ordinary tent poles a frame composed of a ridge and hollow upright of galvanized sheet iron, and a wooden pole of the ordinary form.

The hollow upright, forming the stovepipe as well as one of the supports of the tent, is of a special patented construction, securing great strength and rigidity, and at the same time being very light. It sets in from the end of the tent a sufficient distance to prevent injuring the canvas by heating, and its upper end is provided with a chimney cap or cowl, which projects over the canvas. Near the lower extremity of the hollow upright a stove is attached in such a way that it accompanies the tent in all its swaying motions. The stove is supported by the upright and a single hinged leg, and is readily and easily placed and as readily detached and put aside when not in use.

Referring to the engraving, A is the stove which is attached to the vertical pipe, B, and the latter extends upward through the hollow ridge, C. The other end of the ridge is supported by the pole, D. The frame folds compactly together, as shown in the perspective view, Fig. 2, and transverse section, Fig. 4, and is secured by means of straps attached to the wooden pole, D. The chimney cap is carried in the stove, and the leg of the stove is converted into a handle, as shown in Fig. 3.

It will be seen that nothing is added to the bulk of the tent fixtures but the stove, and the frame is more compact and portable than the ordinary poles. This useful invention has been covered by two patents by Capt. Charles W. Hobbs, of the U. S. Army. Mr. William A. Percy, of Plattsburg, Clinton county, N. Y., is agent and manufacturer. The inventor may be addressed in care of Mr. Percy.



HOBBS' WALL TENT AND STOVE.

MISCELLANEOUS INVENTIONS.

Mr. Joseph Kintz, of West Meriden, Conn., has patented an improved process for giving an ornamental surface or finish to iron castings, which process is as follows: The casting is first rolled or tumbled in the usual manner, and polished on the portions of the surface that are to have a polish on the finished article, and then the casting is coated with copper or other metal by electroplating. It is next subjected to acid bath, for cleaning, and then buffed to render the surface smooth and bright. It is then boiled in a tin or other metallic solution. The solution will deposit evenly over the entire surface, and the polished portions will be left brilliant, thereby forming a fine contrast with the unpolished surface and giving a fine polish and effect. The polishing previous to the electroplating, and the buffing subsequent thereto, are essential steps in the process, and by the boiling in a metallic solution the desired color and a bright clean finish are obtained without further labor.

An improvement in the class of automatic car couplings in which a bar is employed as the connecting device in place of the link, and is made to engage with spring jaws or catches located within the draw heads, such jaws or catches being operated by levers and connecting rods for the purpose of withdrawing them from engagement with the bar when it is desired to uncouple, has been patented by Mr. James H. Henley, of Leadville, Col.

A simple, convenient, and effective device for stretching wires along posts in the making wire fences, has been patented by Mr. Joshua Fowle, of Iowa City, Iowa. The invention consists of a clamp provided with devices for adjusting and holding it upon a post, and provided also with crank and crank-shaft for stretching and tightening the wire.

An improvement in the class of invalid beds having adaptation and attachments for elevation of the head and shoulder portion, and for introduction of a bed pan beneath a removable section of the mattress, has been patented by Mr. Chambers M. Campbell, of Nashville, O.

An improvement in the class of ironing machines in which the clothes or goods to be pressed are carried between heated rollers or plates by means of endless traveling aprons, has been patented by Mr. Morris Steinbock, of New York city.

A simple, durable, and easily actuated alarm attachment for doors has been patented by Mr. Charles F. West, of Philadelphia, Pa. The invention consists of a peculiar arrangement of lever, striker, and trigger that render the alarm especially durable and of easy operation.

A safety appliance for releasing horses has been patented by Mr. Benjamin F. Strange, of Corvallis, Montana Ter. This invention consists in a hitching appliance so connected with the horse's halter that the halter will be cut if the animal should become entangled in it.

Mr. Mortimer Shea, of Nashville, Tenn., has patented an improved device for attachment to gas meters, to guard against any adjustment of the meter that will cause gas to pass through without being registered, and to indicate to the inspector if there has been any attempt to tamper with the meter.

An improvement in window sashes, patented by Mr. Alphonse Friedrick, of Brooklyn, N. Y., relates to lead sashes, such as are used in illuminated or ornamental windows. As heretofore constructed such windows have been strengthened by iron rods placed at intervals diagonally across the lead frames, and secured thereto by small wires twisted around the bars and soldered to the lead cross strips. Such bars are unsightly. They disfigure the designs, and in large windows the lead sash between the bars is not protected. The object of this invention is to strengthen the lead sashes where required by metal wires, which will be soldered to and hid by the sash.

An improvement in cannon has been patented by Messrs. Patrick P. Brannon and Thomas B. Bunting, of New York city. The invention relates to improvements in breech loading cannon, and particularly to the construction of the breech, the breech block or wedge, and the manner of loading and firing the gun.

A simple device for stretching carpets on the floor, patented by Mr. John B. Eddy, of Stevens Point, Wis., consists of a T-head, with claws for taking hold of the carpet, attached to a ratchet bar spliced to another bar carrying a lever, with which the first bar is moved out from the other, and a pawl or dog which engages the ratchet and retains the bar in the position into which it is moved by the lever.

A wash bench susceptible of being raised in height and of being compactly folded has been patented by Mr. Abram Severson, of Auburn, N. Y. It consists of a tripod, two of the legs whereof are fixed to the head and provided with casters, while the third is pivoted in the head and can be folded around near the other two.

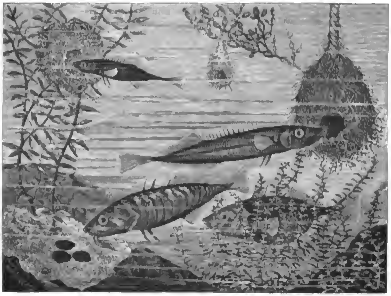
Mr. John A. Hollem, of New York city, has invented an improved trap for catching rats, mice, gophers, and other animals, which is so constructed as to catch an unlimited number of animals in succession. It is simple in construction and convenient in use.

NEST-BUILDING FISH, GASTEROSTEIDÆ.

A. W. ROBERTS.

There is nothing more repulsive than exaggeration in natural history. Surely the phenomena themselves are wonderful enough for the healthy mind if properly set forth. Readers and students are not drawn to the study of nature by such means; indeed, the overdrawn statements, or the classifying of odd and unusual facts, as if of ordinary and regular character, will soon repel the earnest seeker for knowledge, and even the searcher for wholesome entertainment.

The nest-building stickleback is a good subject for this kind of pseudo-science. Sticklebacks *are* wonderful fish, and with them many wonderful things are possible. I know of no other fish that harmonize their colors to the surroundings as do the sticklebacks. Take the many-spined stickleback as an example. In a pond at Maspeth, L. I., which has a bottom of white clay, and was so situated as to be under the full glare of sunlight nearly all day, the color of the sticklebacks was that of a dirty white. A half a mile beyond this pond was a ditch containing peaty water; here the same variety of sticklebacks were brown. A few yards beyond this ditch was a hole, the bottom of which was black creek mud; here the sticklebacks were jet black, even to their eyes. The male fish of the varieties *Gasterosteus biaculeatus* and *aculeatus*, are more wonderful still, as illustrations of this fact. The first indication that a male stickleback, of either of the above named varieties, is about to construct a nest is the taking on of green and red colors, the eye at the same time becoming blue. When the nest is completed, and the time has come to either coax or drive the female to deposit her ova in the nest, then the colors of the male become wonderfully intense, the red becoming almost luminous. The male retains these colors till he abandons the young sticklebacks to shift for themselves.



NEST-BUILDING FISH, GASTEROSTEIDÆ

In nature the male stickleback always selects material for his nest that is in keeping and harmony with the surroundings. This is a wise precaution for masking the contents of the nest from other fish, particularly sticklebacks, who are very fond of their own ova. In the engraving, at lower left-hand corner, a male of the three spined stickleback (*Gasterosteus biaculeatus*) is shown carrying in his mouth material for the nest, while Mrs. Stickleback, heavy with ova, waits behind the plants for the completion of the nest.

The following description of how a sticklebackery was established is taken from the "Young Scientist." I knew it to be truthful in every particular:

"Up in the hayloft was a box of window glass; taking a number of panes of glass, I formed in a washtub a series of compartments, in the following manner: From the center of the tub the panes of glass radiated till they came in close contact with the sides of the tub, thus forming a series of acute angles; the bottom edges of the glass were then crowded down through the three inches of sand till they rested on the bottom of the tub. In the apexes of the angles bunches of mermaid weed were planted; this also helped to sustain the glass compartments, as well as to keep up a thorough oxygenation of the water. In each compartment I placed a pair of sticklebacks, giving them a meal of angle worms before leaving them for the night. Next morning, when I examined the tub, to my great surprise, many nests had been built during the night; in some of them the bright yellow eggs showed plainly through the openings of the nest. Every nest was being vigorously ventilated by the male fish, who were hard at work fanning a current of water on them with their pectoral fins. In one compartment a male fish was tearing off small pieces of confervæ that grew on the mermaid weed, which he carried in his mouth to the nest, packing it down with his nose. After placing several mouthfuls in this way, he fastened the pieces together more compactly by pressing them down with the underside of his body, at the same time exuding a marine glue, so to speak, that cemented all together securely. In the center and on the top of each nest were four orifices, and into these the male, after a considerable display of anger and much labor, at last drove the female, her head projecting far enough out to allow her to breathe. In a few minutes the male drove her out of the nest head first, he now passing through the nest and over the eggs, just to see if Mrs. Stickleback had laid her eggs in the proper place, and to make things all right. In an instant he was out, flaring all over with blue, green, and orange, his eyes looking like small turquoises. When the openings of the nest became too large, he contracted them by patching on more confervæ. Over the nest he remained day and night, changing from one opening to another, constantly fanning a current of water through them. Whenever poor Mrs. Stickleback showed herself, her mate drove at her fiercely, biting her till she was glad to hide in the mermaid weed. The trouble was that she would have eaten all the eggs if she had had a chance, and he knew it. For this reason I took all the females out as soon as they had deposited their eggs. As each nest was completed and the eggs deposited, I withdrew the glass partitions; but terrible battles taking place between the males, I had to replace them. Even then they would try to fight each other through the glass. When all the eggs were hatched, and the bottom of each compartment seemed alive with young sticklebacks, I removed all the male fish and glass partitions, and in a few weeks was the happy possessor of a large school of inquisitive, restless baby sticklebacks."

The many-spined stickleback (*Gasterosteus occidentalis*) is called by dealers the "nine-spined" stickleback. At the upper left hand corner of the engraving is shown the nest and male of this variety. It is very seldom that the many-spined build when in confinement; I have known of only one instance, which occurred when connected with the aquaria at Barnum's (old) Museum. Unfortunately the nest was torn to pieces by a number of small eels before the eggs had hatched. The drawing here presented was made from a sketch I made of the nest as soon as it was completed. This nest was constructed in the branches of a mass of *Ludwigii*, and was composed of small fragments of dead aquatic plants and confervæ. The fibrous structure of the confervæ, and the thready consistency of the glutinous excretion of the male, had been utilized for securely binding the nest to the branches of the *Ludwigii*. The male of this variety becomes black during the season of incubation. I have known this variety of stickleback to ascend small fresh water streams of Long Island, many miles above the brackish water, and remain there for several seasons before returning to the ocean. The largest sized specimen I have ever taken of this variety was two and a half inches long, which is very unusual. When a number of these nine-spiners are placed in an aquarium they are very apt to school and boss everything in the tank.

To the right-hand side of the engraving is a representation of the fifteen spined stickleback (*Gasterosteus spinachia*) and nest. This fish is a native of England. He is a long-bodied, long-snouted fish. On certain parts of the English coast these fifteen-spiners have at times swarmed the coast in such vast quantities that they were used for manuring the land. The nests (says the "Naturalist's Library") of the fifteen-spined stickleback are about eight inches in length and pear-shaped, formed of branches of common fucus and various corallines. These are all bound together in one confused compact mass, by means of a thread run through and round in every conceivable direction. This thread is of great length, and as fine as ordinary silk, and somewhat elastic, whitish, and formed of some albuminous secretion. The eggs are laid in the middle of the nest, in several irregular masses of about an inch in diameter, each consisting of many hundred ova, which are of the size of ordinary shot, and of a whitish or amber color. It would appear that the fish must first deposit its spawn amid the growing fucus, and afterwards gather its branches together round the eggs, at the same time weaving and incorporating all the rubbish that is lying or floating round the nucleus. Mr. Couch mentions a case where a pair of fifteen-spined sticklebacks made their nest in the loose end of a rope, and from which the separated strands hung out about a yard from the surface, over a depth of four or five fathoms, and to which the materials could only be brought, of course, in the mouth of the fish, from the distance of about thirty feet. The nest was formed of the usual aggregation of the finer sorts of the red and green seaweeds, but were so matted together in the hollow formed by the untwined strands of the rope, that the mass constituted an oblong ball of nearly the size of the fish, in which had been deposited the scattered assemblage of spawn. This was bound into shape with a thread

PANDA OR WAH.—[See next page.]

of animal substance, which was passed through and through in various directions, while the rope formed an outside covering to the whole. A picture of this nest is shown in the illustration.

On our neighboring coast are several varieties of sticklebacks. The two best varieties as nest builders are *Gasterosteus biaculeatus* and *G. aculeatus*. They are distinguished by the two prominent spines on the back and a smaller spine just in front of the dorsal fin. The size of these varieties varies from two and a half inches to three inches. The body is covered on each side with a series of narrow vertical plates. The general color of these varieties is olive green on the back and that of oxidized silver on the sides.

These fish reach our coast in schools from the ocean during the early part of March. This year they were taken by collectors as early as February. I have seen the margins of ditches of brackish water on Long Island fairly alive with both sticklebacks and sheepshead lebias that had been deposited there by the spring tides. The sticklebacks and lebias were nesting side by side in perfect harmony.

Some years ago I knew of a pond of water that had become land locked from the tide that had flowed into it from Wallabout Bay. In this pond were hundreds of three-spined sticklebacks, whose habits had undergone a complete change, viz., five and oftentimes as many as ten females had spawned in one nest, the male fish in attendance always increasing the size of the nest to cover the extra deposits of ova, and at the same time taking entire charge of all the masses of eggs. These sticklebacks had become very much dwarfed. Both in nature and in artificial confinement the male stickleback always selects for the situation of the nest a sunny spot. A good illustration of this fact was that of a stickleback that had nested in a self-supporting tank, which was so situated that the sun shone on it for only half an hour each day, and that in a far off corner from where the nest was situated. So anxious was the male fish to obtain the benefit of this sunlight that every day he carried the mass of eggs in his mouth and placed them on the branches of an aquatic plant, where the sun's rays were strongest, after which he replaced them in the nest.

At one time I had a tank of sticklebacks at Barnum's, the bottom of which consisted of plain sand. In this tank were a large number of ripe sticklebacks, but not a particle of nesting material. One morning, greatly to my surprise, I noticed in each of the lower corners of the tank a male in full color hovering over masses of brownish material, with that peculiar vibratory motion of the male stickleback when ventilating the eggs. On taking out one of the masses I discovered it to be composed of fine-cut chewing tobacco.

I have often placed obstructions on the nest of a stickleback during its formation, the male always removing them when not too heavy to carry in his mouth. The male when building constantly tests the specific gravity of the materials selected. He having selected what appears to be a suitable fiber, he carries it a little way, then projects it from his mouth a short distance, and watches it fall; if it falls rapidly it is taken, if slowly it is rejected. When the young sticklebacks wander too far from the nest the male takes them in his mouth and deposits them near the nest. The eggs of the stickleback at first are of a light yellow color, but as they approach maturity they become darker; in course of time minute black spots appear, which are the eyes of the young fish inside of the eggs. The eggs of stickleback can be hatched very easily, by placing them in slightly running water, or by changing the water twice a day. The young fish are apt to die unless they are placed in water containing large quantities of animalcula, which they devour in large quantities. For this reason, as soon as the umbilical sack is absorbed they should be placed in a tub, or other vessel wherein the water has been under the influence of sunlight and the action of plants for some weeks, thus securing an abundant supply of natural food.

The best places to collect sticklebacks in the vicinity of New York is in the standing ditches on Long Island; also at the rear of Gunther's Railroad Station at Coney Island. The ditches back of the railroad station at Canarsie generally contain hundreds of sticklebacks in the months of March, April, and May.

THE PANDA, OR WAH.

There are few of the mammalia which are decorated with such refulgently beautiful fur as that which decks the body of the wah or panda, as it is also called.

This beautiful creature is a native of Nepal, where it is known under the different names of panda, chitwa, and wah—the last mentioned name being given to it on account of its peculiar cry. The fur of the panda is of a bright rich chestnut brown, which rapidly darkens into a peculiarly rich black upon the ribs and the outside of the legs. The head is of a whitish-fawn color, with a ruddy chestnut spot under each eye. The tail is of the same chestnut hue as the body, and is marked with a series of dark rings. The head is very short and thick muzzled, presenting a curious contrast to the coatis and racoons. See engraving on previous page.

It is generally found among the trees that grow near rivers and mountain torrents, but does not seem to occur in sufficient numbers to render its beautiful fur an object of commercial value. This is the more to be regretted, as the coat of the panda is not only handsome in appearance, but is very thick, fine, and warm in texture, being composed of a double set of hairs, the one forming a thick woolly covering to the skin, and the other composed of long glistening hairs that pierce through the wool and give the exquisitely rich coloring to the surface of the fur. The soles of the feet are not merely defended by nailed and thickened cuticles, but are furnished with a heavy covering of woolly hair, which in some species is of a light gray color, and in others of a snowy white, that contrasts strangely with the deep rich black of the legs and paws.

The food of the panda is usually of an animal character, and consists chiefly of birds, their eggs, and the smaller mammalia and insects, many of which it discovers on the trees whereon it is generally found.

Luminous Fungi.

There are no phenomena associated with fungi that are of greater interest than those which relate to luminosity. The fact that these plants under some conditions give out a phosphorescent light has long been known; and every school-boy is familiar with the luminous property possessed by rotting wood ("fox-fire"), and which is due to the mycelium of a fungus pervading its substance. This luminosity of fungi has been observed in various parts of the world, and where the species has been fully developed it has generally been found to be one of the toadstools belonging to the genus *Agaricus*. One of the best known species is the *Agaricus olearius* of Southern Europe, which was examined by Tulasne with especial view to its phosphorescence. In his introductory remarks, he says that four species only of the Agarics that are luminous appear at present (1848) to be known. One of them is the species just mentioned, another, *A. igneus*, comes from Amboyna; the third, *A. noctilucus*, has been discovered at Manila; and the last, *A. gardneri*, is produced in the Brazilian province of Goyaz upon dead leaves. The Agaric of the olive tree (*A. olearius*), which is itself very yellow, reflects a strong brilliant light, and remains endowed with this remarkable property while it grows, or, at least, while it appears to preserve an active life and remains fresh. The phosphorescence is at first, and more ordinarily, recognizable at the surface of the gills; but in many cases, and among more aged fungi, the gills cease to give out light, and the stipe throws out a brilliant glare. Tulasne, who examined this subject very carefully, infers from his experiments that the same agents—oxygen, water, and warmth—are perfectly necessary to the production of phosphorescence as much in living organized beings as in those which have ceased to live. In either case, the luminous phenomena accompany a chemical reaction, which consists principally in a combination of the organized matter with the oxygen of the air; that is to say, in its combustion, and in the discharge of carbonic acid which thus shows itself. Mr. Gardner has graphically described his first acquaintance in Brazil with the phosphorescent species which now bears his name (*A. gardneri*). It was encountered on a dark December night, while he was passing through the streets of Villa de Natividate. Some boys were amusing themselves with a luminous object, which at first he supposed to be a large fire-fly, but on making inquiry he found it to be a beautiful phosphorescent toadstool, which, he was told, grew abundantly in the neighborhood on the decaying leaves of a dwarf palm. The whole plant gives out at night a bright light somewhat similar to that emitted by the larger fire-flies, having a pale greenish hue. From this circumstance, and from growing in a palm, it was called by the inhabitants "Flor de Coco." The number of recognized luminous species of *Agaricus* is not large, though three or four others may be enumerated in addition to those already cited. Of these, *A. lampas*, and some others, are found in Australia; and Dr. Hooker speaks of the phenomena as common in Sikkim, but he was never able to ascertain with what species it was associated. As regards Australian species, interesting information is given in regard to two by Mr. James Drummond, in a letter from Swan River. These grew on stumps of trees, and had nothing remarkable in their appearance by day, but by night emitted a most curious light, such as he had never seen described in any book. One species was found growing on the stump of a *Banksia*, which was surrounded by water. It was on a dark night, when passing, that the curious light was first observed. When the fungus was laid upon a newspaper, it emitted by night a phosphorescent light, enabling persons to read the words around it, and it continued to do so for several nights with gradually increasing intensity as the plant dried up. In the other instance, which occurred some years after, Mr. Drummond, during one of his botanical trips, was struck by the appearance of a large toadstool, measuring sixteen inches in diameter, and weighing about five pounds. This specimen was hung up to dry in the sitting-room, and on passing through the apartment in the dark it was observed to give out the same remarkable light. The luminous property only ceased when the plant became dry.

In the current number of the *Gardener's Chronicle*, the Rev. M. J. Berkeley describes still another species, new to science, recently received by him from the Andaman Islands, and which, though small in size, exceeds in brilliancy any species that has hitherto been observed. In this species, which Mr. Berkeley names *Agaricus emerici*, the entire substance of the fungus is described as being most brilliantly luminous. There are a few other fungi belonging to genera other than *Agaricus*, which have been observed to be luminous under certain conditions; *Thelephora phosphorea* and *Polyporus sulfureus*, for example, the latter being a common American species. In all the cases of phosphorescence recorded as occurring in these cryptogamic plants, the light emitted is described as of the same character, varying only in intensity. It answers well to the name applied to it, as it seems remarkably similar to the light emitted by some living insects and other animal organisms, as well as to that evolved, under favorable conditions, by dead animal matter—a pale, bluish light, resembling that emitted by phosphorus as seen in a dark room.

A New Fiber.

In the Paris Exhibition was shown a sample of a fiber named *Malachra rotundifolia*, sent from Bombay. This plant is, however, only found in South America—at least so says Dr. King, to whom the supposed *Malachra rotundifolia* was sent for identification, and he states that it is *Malachra capitata*, not *Malachra rotundifolia*. As a fiber, be it what may, it undoubtedly deserves attention, for it is said to be quite equal to jute. The following is the description given of it: "The fiber is in length from eight feet to nine feet, has a silvery appearance, with a peculiar luster, and is almost as soft as silk. In passing the fiber through the machinery damped with oil and water, as is commonly done with Bengal and Koukan jute, yarn was produced strong enough and nearly equal to that made from the second quality of Bengal jute. If the plant is carefully grown and well looked after, the fiber would then no doubt rank fully equal to Bengal and Bombay jute. Owing to the high prices ruling for jute in Bengal and elsewhere, the new fiber, if carefully prepared, would command a ready sale at 3·12 rupees to 4 rupees per Indian maund." There appears to be no difficulty in growing this plant, which belongs to the natural order of *Malvaceæ*, in Bengal, marshy places within the tropics being considered favorable to its growth, and there is, therefore, every reason why a fair trial should be made of its apparently valuable properties. The fiber is prepared in precisely the same way as jute, but requires to be steeped directly it is cut, as exposure to the sun dries and hardens the stems, preventing the easy removal of the bark from them, and rendering the fiber itself coarser in quality than it would otherwise be.

Human Filariæ and Mosquitoes.

The new investigations of Dr. Manson, communicated to the Quekett Club recently, appear to afford positive proof of a singular habit on the part of the filariæ. These microscopic worms periodically pass in and out of the circulation. Dr. Manson gives a table showing the hours of the day and night at which they are either present or absent in the blood. The worms are remarkably punctual in keeping to their appointed times. The evening inrush to the circulation commences about half-past seven, the over-crowding attaining its maximum at midnight. Into the clinical bearings of the subject it will be time to enter when the remarkable evidence brought forward by Dr. Manson has been fully published in the "Transactions" of the Club. In addition to some introductory remarks by himself, the President read brief communications on the subject of filariæ from Drs. Somerville, Mortimer-Granville, J. Bancroft, J. L. Paterson of Bahia, and others. The meeting was well attended, and in the course of the discussion which followed, Dr. Stephen Mackenzie stated that he had at present under his care, in the London Hospital, a patient from Calcutta, with chyluria. Although Dr. Lewis had found filariæ in the blood of this man in India, Dr. Mackenzie's efforts to find the filariæ had at present been unattended with success. The interest of the various papers was much increased by the exhibition of drawings and specimens of the filariæ in all the stages of growth hitherto observed. Numerous infested mosquitoes were also shown.—*Lancet.*

New Observations concerning Bees.

Mr. E. A. Thompson writes to the *American Naturalist* that certain moths, *Plusia precationis*, having been caught by their tongues in the pollen-pockets of *Physianthus albens*, an Asclepiad plant, were stung to death and devoured by what were supposed to be ordinary honey bees. Dr. Hermann Müller considers the fact of the moths being thus entrapped new and interesting; but mentions that his brother, Fritz Müller, in South Brazil, has observed bees eagerly licking the juice dropping from pieces of flesh which had been suspended to dry in the air. Mr. Darwin suggests that the bees may possibly tear open the bodies of the moths in order to get at the nectar contained in their stomachs. Both these distinguished naturalists recommend further observation. It is stated by Prof. A. J. Cook, of the Michigan Agricultural College, that bees kill the drones not by stinging, but by tearing with the mandibles.

Causes of Fatigue in Reading.

An important study has been made of this subject by Dr. Javal, director of the Laboratory of Ophthalmology of the Sorbonne, published in the *Annales d'Oculistique*. The fatigue of the eyes which is so often complained of by literary men he believes due to a permanent tension of accommodation; reading requires constant, steady strain of the eyes, while many other occupations demanding close, do not need constant, sight. His researches extend to the question of great economical importance: Given a surface of paper and a number of words to print upon it, what rule will secure the maximum of legibility? The answer is: Other things being equal, the legibility of a printed page does not depend on the height of the letters, but on their breadth. This fact is of special importance in the preparation of school books, and Dr. Laval's suggestions should receive the attention of publishers, type founders, and school boards.

Correspondence.

The Edison Lamp Tests.

To the Editor of the Scientific American:

I have read to-day with much interest the results of Messrs. Morton, Mayer, and Thomas's experiments with an Edison electric lamp, published in the SCIENTIFIC AMERICAN of April 17. The results obtained, so far as they relate to the resistances of the loop while giving lights of different intensities, and the current required for a light of fifteen candles, are valuable, but those given relative to the cost of one hundred and twenty candles are of *no* value, because it is (evidently) premised that the twelve lamps are to be in series in a single circuit, whereas, in Mr. Edison's proposed system, each one of the twelve lamps would be placed in a branch circuit by itself, or in other words, in multiple arc; and the cost then would be much less than the Stevens Institute experimenters' report. The resistance of the armature of Mr. Edison's generator is so small that it may be neglected entirely, without seriously affecting the value of calculations, and the resistances of the leading wires may also be made so small that their neglect will not make any appreciable difference. This being the case, let us see what would be the actual amount of coal required to maintain twelve electric lights in multiple arc, having a total intensity of one hundred and twenty candles.

Before entering upon this calculation, however, let us determine the electro-motive force required to supply a current of 0·905 weber, in a circuit of 76 ohms resistance. Multiplying the current by the resistance gives 0·905 × 76 = 68·78, which would be the required electro-motive force in volts. Now, then, place the twelve lamps of 76 ohms resistance each in multiple arc, and their joint resistance will be one twelfth part of that of a single lamp, or 6 1-3 ohms. As the current generated by the machine is to be divided among twelve branch circuits, so that each circuit will receive a current of 0·905 weber, it is obvious that the total current generated by the machine must be twelve times that required for a single circuit, or 10·860 webers. Multiplying the current by the resistance (as we did for the single lamp) gives 10·860 × 6 1-3 = 68·78, which is the required electromotive force, in volts, and is exactly the same as that required for a single lamp. Hence, even with a Brush or Siemens machine, where forty per cent of the original energy is lost, the amount of coal required to operate twelve lamps giving an intensity of one hundred and twenty candles, is only five twelfths of one pound, instead of five pounds, as calculated by the aforesaid experimenters.

This shows a pretty large margin below the cost of producing a somewhat less light by coal gas, and in practice the margin would be still greater, for Mr. Edison's generator is said to transform considerably more than sixty per cent of the original energy into effective current.

Respectfully yours, WM. C. RAMSDELL.

Norwich, Conn., April 9, 1880.

AGRICULTURAL INVENTIONS.

A revolving hay rake, so constructed that the rake head may be raised to pass obstructions and miss hay without discharging the collected hay, may be conveniently adjusted with the teeth at any desired inclination, and may be readily tripped to discharge collected hay, has been patented by Mr. Jacob S. Oberholtzer, of Wadsworth, Ohio.

A spring harrow tooth, made in two parts, whose point is vertically adjustable in such a manner that it may be raised or lowered without altering its pitch or draught, and the tooth be thereby stiffened or made more flexible for deep or shallow work, has been patented by Mr. Perry A. Peer, of Comstock, Mich.

An improved sugar cane cutter, patented by Mr. Philip Seitz, of Baton Rouge, La., is an improvement on the machine for which letters patent No. 196,596 were granted to the same inventor, October 30, 1877.

An improved machine for removing bugs from potato vines, has been patented by Goodrich E. Risley, of Waterville, N. Y. The object of this invention is to furnish a new machine for removing bugs from potato vines and catching them, so that they may be readily destroyed.

Mr. John Hill, of Columbus, Ga., has invented a feed indicator for cotton openers. This invention relates to a convenient and certain means for determining the quantity of cotton to be fed to cotton openers. The latter machines are devices which serve to tear up and loosen the tussocks of cotton as they come from the bale and distribute the fiber in the form of a fleece. In using these openers two are sometimes employed together to act successively upon the cotton; or one opener may be employed in connection with a lapping machine, the function of which latter is to press together and compact into a fleece. In either case a hollow trunk has been employed as a conduit, in connection with a blast of air passing through the same, to act as a vehicle to carry the fleece from one opener to the other, or from the opener to the lapping machine, which second machine is generally located upon a different floor, or at a point more or less remote from the first. This invention has more special reference to what is known as "Kitson's Trunk System of Opening Cotton;" but it can be used in any similar system where the opener is located at some distance from the second opener or lapper, and cotton is supplied from the first to the second through a trunk or flue. The invention consists in making the boxes of the upper feed roll of the second opener or lapper vertically adjustable and connecting them with an index hand within sight of the operator at the first machine, so that the operator, at a point remote from the second machine, can tell the amount of cotton fed to the second machine by the rise or fall of the movable roller due to the passage of a greater or less quantity of cotton to the second machine.

The Comet as Seen in Australia.

The Melbourne *Argus* says: "The tail of a large comet was discovered in the southwestern heavens, near the horizon, on February 2, soon after sunset. The nucleus could not be seen either on the 2d or 3d, but about 25° length of tail were visible. The extremity of the tail on the 2d reached to β Gruis, and next night it had shifted considerably to the northward so as to pass close by θ Gruis. On the first night it made an angle of 50° with the horizon, and on the second 80°. Owing to the misty state of the air and the closeness of the comet to the sun, no favorable observations could be made in Melbourne on the first or second night."

The *Argus* of the 5th of February says: "Owing to the presence of clouds and a hazy sky no continuous observation of the comet could be made at the observatory last night. The best view of the visitor was obtained at 8:35 P.M., when it extended 32° above the horizon. Occasionally the sky cleared, so that a view could be obtained nearly down to the horizon, but the nucleus of the comet was not visible. The tail had slightly diminished in brightness from the previous evening, and was rather less curved. It appeared to be almost perpendicular to the horizon, and had moved slightly to the northward. Its length had considerably increased since Tuesday evening. Until the nucleus has been observed no knowledge can be obtained as to the direction in which the comet is traveling or its actual position in the heavens. It will probably be two or three weeks before any definite information on these points can be obtained. We have received the following telegram: 'Perth, February 4. A long stream of lustrous light, resembling the tail of an immense comet, is visible a little above the horizon in the western heavens. It appears to be making an easterly course.'"

Canadian Weather.

Mr. H. G. Vennor, of Montreal, whose boldness in weather predictions has brought him into such prominence, says that the extreme cold of Canada is almost always produced by a wind blowing from a point to the north of west. Such a wind is both cold and dry. Being dry, in passing along it imbibes moisture rapidly, causing cold. Being also cold, it quickly absorbs heat from the surface of the earth; and when this continues for several hours of any day, and toward sunset it becomes calm, we then usually have the lowest state of the thermometer. In Canada, these extremes of cold usually last about three days; the nor'wester beginning about noon of one day, blowing fiercely for that afternoon, becoming almost calm in the evening—then a cold night. Next day the wind is not so high, but still from a northwesterly point. Again, toward sunset, there is a calm, with the thermometer more or less below zero. In the morning, it may be observed that the force of the cold is breaking. If the wind veers round in a point south of west, there will be a few flurries of snow, very threatening in appearance, but amounting to very little in reality, no snow storms of consequence coming from the west. If, on the other hand, the wind passes to the east, several hours of bitter cold may be expected, followed by a general snow storm lasting from twenty to thirty hours.

Paper Clay.

In view of the rapid rise in the price of paper, and the complaints of the paper makers with regard to the scarcity and increasing costliness of all sorts of paper stock, it is gratifying to see that one source of such raw material is not likely soon to fail us. Whatever may happen to rags, wood pulp, and the thousand other sorts of fibrous material supposed to enter into the composition of paper, the clay bank promises to be inexhaustible. True, the majority of people who pay a high price for paper may have a prejudice against that material, but evidently the owners of the clay banks have not; for in a prominent journal devoted to the paper trade, they boldly print a large cut of their "clay works," showing a long stretch of snowy bluff out of which a huge section has been cut, presumably to supply the needs of "all first-class mills, east and west," to whose owners they refer for evidence of the excellence of their clay.

The American Society of Mechanical Engineers.

The organization of the American Society of Mechanical Engineers was completed April 7, at a numerously attended meeting in the hall of Stevens Institute, Hoboken. The society will embrace members, honorary members, associates, and juniors, and is open to mechanical, civil, military, naval, mining, and metallurgical engineers, and architects of practical attainments as designers, constructors, or teachers, if they apply for full membership. A junior must have been in practice for two years, or must be a graduate of an engineering school. The first regular annual meeting will be held in this city in November next. The election of officers resulted as follows: President, R. H. Thurston; Vice-Presidents: H. R. Worthington, Coleman Sellers, Eckley B. Coxe, General Q. A. Gillmore, U. S. A.; Wm. H. Shock, U. S. N.; Alex. L. Holley; Managers: W. P. Trowbridge, Theo. N. Ely, J. C. Hoadley, Washington Jones, Wm. B. Cogswell, F. A. Pratt, Chas. B. Richards, Wm. B. Bement, S. B. Whiting; Treasurer, Lycurgus B. Moore.

Blacksmith's Hammer Signals.

When the blacksmith gives the anvil quick light blows it is a signal to the helper to use the sledge, or to strike quicker.

The force of the blows given by the blacksmith's hammer indicates the force of the blow it is required to give the sledge.

The blacksmith's helper is supposed to strike the work in the middle of the width of the anvil, and when this requires to be varied the blacksmith indicates where the sledge blows are to fall by touching the required spot with his hand hammer.

If the sledge is required to have a lateral motion while descending, the blacksmith indicates the same to the helper by delivering hand hammer blows in which the hand hammer moves in the direction required for the sledge to move.

If the blacksmith delivers a heavy blow upon the work and an intermediate light blow upon the anvil, it denotes that heavy sledge blows are required.

If there are two or more helpers the blacksmith strikes a blow between each helper's sledge hammer blow, the object being to merely denote where the sledge blows are to fall.

When the blacksmith desires the sledge blows to cease, he lets the hand hammer head fall upon the anvil and continues its rebound upon the same until it ceases.

Thus the movements of the hand hammer constitute signals to the helper, and what appear desultory blows to the common observer, constitute the method of communication between the blacksmith and his helper.

Strawberries in South Carolina.

A Charleston newspaper notes a steady decline in the price of strawberries in South Carolina since they were first cultivated for northern markets. In 1872, they brought an average price of 57 cents a quart; in 1873, 33 cents; in 1874, 38 cents; in 1875, 29½ cents; in 1876, 21 cents; in 1877, 20 cents; in 1878, 11½ cents; in 1879, 14 cents; and this year the average is estimated at about 12½ cents. The decline in price is, of course, easily traceable to the increase of the crop raised, and to the nominally lower price of all products due to the return of the currency to a specie basis. Taking the acreage this year at 225, and the average yield at 4,000 quarts to the acre, the yield will be 900,000 quarts, which at an average of 12½ cents a quart, will return an income of $112,500.

The Fish Hawk Finished.

The new steamer Fish Hawk, especially designed for the propagating work of the U. S. Fish Commission, is at last ready for work. She is a double screw steamer of about 600 tons, fitted up so as to be able to take the spawn of any variety of fish, and complete the hatching of the young fry in their native waters. This obviates the necessity of the long and expensive journeys with young fish which have entered so largely into the labors of the commission heretofore. Besides in the propagation of many species of fish, the floating hatchery is found to be much more successful and satisfactory than any establishment can be on shore.

The Brooklyn Bridge.

A new impetus has been given to the work on the Brooklyn bridge by the passage and signing of an appropriation bill at Albany, ordering the City of New York to pay $750,000, and the City of Brooklyn $1,500,000—total, $2,250,000, to enable the trustees to finish the work. The president of the Board of Trustees of the bridge reports that the speedy execution of the various contracts in connection with the superstructure will be insisted on, and that there is no reason to suppose that there will be any further delays. The removal of the remaining buildings in the way of the approaches to the bridge is going on, and the rapid execution of the rest of the great work is confidently promised.

The Vesuvius Railway.

Tourists are now able to visit the crater of Vesuvius without the labor of climbing, the railway being complete. The depot is situated at a height of 810 meters, or 210 meters above the Observatory. A restaurant and café capable of accommodating 100 people is attached to the depot. The angle of inclination of this railroad attains at various points 40°, 50°, and 63°. There are two passenger cars, the Vesuvius and Etna, accommodating 12 persons each. The system adopted in the construction of the railway is of American invention, and is known as "the prismatic system."

Pioneer Paper-Makers.

Two veteran paper makers, Stephen Thacher and Joseph Reed, have lately passed away. Mr. Thacher was within a week of reaching his hundredth year. He built the first paper mill at Lee, Mass., thus laying the foundation of what has become the great industry of that town. Of late years he has resided at Saratoga Springs, N. Y. Mr. Reed was ninety years of age when he was killed on a railway near Springfield Station, Pa. He was poor as well as old, and apparently without near relatives. Personally, he was probably known to more paper makers than any other man of the craft.

If an invention is worthless and it fails of public support, *no one suffers but the inventor.* If it is *good* and succeeds, the *whole world reaps* the benefit. The public, which pays nothing in the one instance and gains enormously in the other, is thus vitally interested in the encouragement of inventions and the upholding of our patent system.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

OFFICE BIGELOW BLUE-STONE COMPANY, 247 BROADWAY, NEW YORK, April 8, 1880.

H. W. Johns M'f'g Co., 87 Maiden Lane, New York.

GENTS: Owing to the fire which occurred on the morning of February 1, at the works of our blue-stone and planing mills, situated at Malden, on the Hudson, we shall shortly require more of your roofing material, and would like quotations for same. That portion of the building covered with shingles was entirely consumed, but we take pleasure in stating that when the flames reached that part covered with your Asbestos Roofing the edges fell over that part of the roof and prevented further progress of the flames. The building would have been a total loss had it not been for your roofing.

You are at liberty to make any use you choose of this letter, and refer any one to us as to the merits of the Asbestos Roofing. Respectfully yours,

JOHN MAXWELL, Lessee

G. W. Baker, Wil., Del., makes the Post Band Saw for hand, foot, and steam. Will cut 3 inches thick of hard wood.

For round text hand and for a pen to stand hard usage, try Esterbrook's Exquisite, No. 30. Ask your stationer for them.

Wanted—Situation by Draughtsman. Technical education, bridge work; general machinery or tools. Address A. B. C., Davis St., Elmira, N. Y.

Power, Foot, and Hand Presses for Metal Workers. Moderate prices. Peerless Punch and Shear Co., 52 Dey St., New York.

Valuable Patents for Sale or Lease on Royalty to good party. Address P. E. Bird, Jenkintown, Pa.

H. L. Perrine, Mech. Draughtsman, 617 7th St., Washington, D. C. Drawings for inventors from sketches or models.

For Sale.—U. S. and Canadian Patent for a Blind Stitch Sewing Machine; a valuable invention. Address P. Hoffman, 187 East Genesee St., Buffalo, N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., sole manufacturers, Fitchburg, Mass.

Catalogue of Useful Books on Applied Science sent free. E. & F. N. Spon, 446 Broome St., New York.

Blake Lion and Eagle Imp'd Crusher. See adv. p. 286.

Foundry and Machine Shops for sale. Established in 1846. Write for description to B. J. Hoen, Addison, Steuben Co., N. Y.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

Spokes and Rims, white oak and hickory, best quality, to any pattern, and Hammer Handles of best hickory. John Fitz, Martinsburg, West Va.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $3. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Fore-paugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 269.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave., Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Portable Forges, $10. Roberts, 107 Liberty St., N. Y.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 291.

Peck's Patent Drop Press. See adv., page 286.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 284.

For Separators, Farm & Vertical Engines, see adv. p. 251.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 254.

For Patent Shapers and Planers, see ills. adv. p. 254.

For Alcott's Improved Turbine, see adv. p. 270.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 254.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Chase's Pipe Cutting & Threading Machine. Send for circular. Chase Machine Co., 120 Front St., New York.

Silent Injector, Blower, and Exhauster. See adv. p. 269.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Solomon's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Horizontal Steam Engines and Boilers of best construction. Atlantic Steam Engine Works, Brooklyn, N. Y.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 268.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 270.

The "Fitchburg" Automatic Cut-off Horizontal Engines. The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass.

We will purchase or manufacture on royalty, patented articles of real merit. Farley & Richards, Phila., Pa.

Millstone Dressing Machine. See adv., page 269.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 733 Broadway, N. Y.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 190.

Telephones.—Inventors of Improvements in Telephones and Telephonic Apparatus are requested to communicate with the Scottish Telephonic Exchange, Limited, 24 St. Andrew Square, Edinburgh, Scotland. J. G. Lorrain, General Manager.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

New Economizer Portable Engine. See illus. adv. p. 269.

Cutters shaped entirely by machinery for cutting teeth of gear wheels. Pratt & Whitney Co., Hartford, Conn.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 269. Totten & Co., Pittsburg.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) H. L. R. writes: I have an upright tubular boiler, and it leaks around the tubes in the head. I have expanded the tubes several times, and they do not stay in their places. What can I do to make them stay? I thought that they could be fixed by putting a ferrule on the inside and then expand it. Would that do? A. Your trouble may arise from a deposit of sediment on the lower tube sheet or crown sheet of the furnace, or the tubes may be worn so thin that they cannot be made tight. Ferrules might help you, but they should be of cast iron and turned.

(2) H. & D. D. ask: 1. Can a common machinist make a phonograph that will repeat what has been spoken into it? If so, will you please tell us where we can get a description of one. We are both pretty fair hands with our tools, and we would like to make one. A. Yes. For directions see SUPPLEMENT 133. 2. Is there any way that we could make carbon? We have been experimenting with an electric light, and would like to try and make our own carbon points. A. You will find formula for electric light carbons in "The Electric Light," by Higgs; but we would not advise you to try to make them. It is far better and cheaper to purchase. 3. What part of a horse power is an engine with a cylinder 1 inch by 2 inches, and what size of boiler would it require to drive it, the piston making 26 strokes per minute, using 65 lb. of steam? A. If you mean 26 strokes, it is one-third horse power; if you mean 26 revolutions, two-thirds horse power. In the first case, 8 square feet heating surface in boiler, and in the last 12 square feet. 4. Are the two cylinders of a double acting engine equal to both added together: as, for example, take 11 inch by 20 inch hoisting engine. If we were to use a 22 inch by 40 inch single engine, would it give the same amount of horse power using same pounds steam in both cases? A. Yes; equal to one of 11 inch diameter by 40 inch; but a cylinder 22 inch by 40 inch is equal to four of 11 inch by 40 inch, or eight of 11 inch by 20 inch.

(3) W. J. N. asks: What makes the best polish to clean up and brighten old furniture, pianos, etc., and coffin varnished surfaces? A. Dissolve 4 oz. orange shellac in 1 quart of 95 per cent alcohol; to this add 1 quart of linseed oil and 1 pint of turpentine; when mixed add 4 oz. of sulphuric ether and 4 oz. of aqua ammonia, mix thoroughly and well before using. Apply with a cloth or sponge, and rub the surface to which it is applied until the polish appears.

(4) J. F. M. writes: To tighten a pipe box that has turned and worn the hub away so that it cannot be wedged: Center the box, secure it with three thin strips of wood, and pour melted sulphur around it. As the sulphur cools it expands and holds the box perfectly tight.

(5) J. A. M. writes: I notice quite a difference in the formulas you give in regard to the horse power of belting. Some time ago I took the formula as follows from your paper, of which I have many volumes:

$$\frac{\text{W. in inches} \times \text{S. in feet per minute}}{600} = \text{H. P.}$$

Then February 14 some belting establishment furnishes the following for a 6 inch belt:

$$\frac{8 \times 6^2 \times 1900}{2 \times 33000} = \text{H. P.}$$

Then in the number for March 27, in answer to G. I. B., you say 800 feet inches = H. P. A. The formula $\frac{W \times S}{600}$ = H. P. is considered a good practical rule for belts of average width and length, and is used by many engineers. The formula $\frac{W \times S}{800}$ = H. P., is safer for narrow and short belts running on small pulleys. These formulæ are very simple, and meet the want of practice.

(6) O. asks: Can illuminating gas be made from water? If so, how? A. Yes; when superheated steam is passed slowly through a large body of ignited carbon (coal) it parts with its oxygen to the latter. The resulting gas—composed chiefly of hydrogen and carbon monoxide—has very little illuminating power, but this is remedied by introducing a small quantity of the vapor of some rich hydrocarbon—as naphtha—into the retort with the gases.

(7) G. M. T. asks for a recipe for a reliable shoe gloss. A. Shaw's patent blacking is made as follows: Soft water, 1 gallon; logwood extract, 6 oz.; dissolve by gentle heat; soft water, 1 gallon; borax, 6 oz.; shellac, 1½ oz.; boil until solution is effected; potassium dichromate, ⅛ oz.; water, ½ pint; dissolve and add all together. It is preferred to add to this before boiling 8 oz. of spirit of ammonia or aqua ammonia.

(8) R. A. S. asks how to make a cement for uniting metals to glass. A. Take 1 lb. shellac dissolved in a pint of strong methylated spirit, to which is to be added 0·05 part of solution of India-rubber in carbon bisulphide; or take 8 ounces of a thick solution of glue, and mix with 1 ounce of linseed oil varnish, or ½ of an ounce of Venice turpentine; boil together, and agitate. The pieces cemented should be fastened for 30 or 60 hours to get fixed.

(9) F. B. asks for a good waterproof cement. 1. Soak pure glue in water until it is soft; then dissolve it in the smallest possible amount of proof spirit by the aid of a gentle heat. In 2 oz. of this mixture dissolve 10 grains of gum ammoniacum, and while still liquid add half a drachm of mastic dissolved in 3 drachms of rectified spirit. Stir well, and for use keep the cement liquefied in a covered vessel over a hot water bath. 2. Shellac, 4 oz.; borax, 1 oz.; boil in a little water until dissolved, and concentrate by heat to a paste. 3. Ten parts of carbon disulphide and one part oil of turpentine are mixed, and as much gutta percha added as will readily dissolve. 4. Melt together equal parts of pitch and gutta percha, apply warm, and press the parts firmly together until quite cold. 5. The ordinary marine glue consists of caoutchouc, 1 oz.; genuine asphaltum, 2 oz.; benzole or naphtha, q. s. The caoutchouc is first dissolved by digestion and occasional agitation, and the asphalt gradually added. The solution should have about the consistence of molasses.

(10) A. H. writes: I have a driving or cog wheel, 8 feet in diameter, the pinion 12 inches, band wheel shaft 6 feet long, band wheel 9 feet in diameter. What change can be made to lighten the draught? As it is it takes five horses to run a 40 saw gin. I want to decrease the draught to 2 or 3 horses. A. With the best arrangement you cannot drive a 40-saw gin properly with less than 4 horses. By putting your machinery in line and in good order, you may decrease the friction, so that 4 horses will drive the gin with the present machinery.

(11) W. M. asks: Which is the best for the health of the human kind, beef steak so rare that the blood will follow the knife, or steak cooked through only? A. The cooked meat is best.

(12) A. E. P. asks for a receipt for stain to apply to holly wood to imitate black walnut. A. Paint over the wood with a solution made by boiling 1 part of catechu, cutch, or gambier, with 30 parts of water and a little soda. This is allowed to dry in the air, and then the wood is painted over with another solution made of 1 part of bichromate of potash and 30 parts of water. By a little difference in the mode of treatment, and by varying the strength of the solutions, various shades of color may be given with these materials, which will be permanent, and tend to preserve the wood. After drying slightly oil and finish with shellac varnish if desired.

(13) C. L. T. asks how to put on the watered or mottled appearance to brass articles. A. The brass is first polished to the required degree, and if it is a fine surface, the mottled appearance is imparted by rubbing over it with a gyratory motion a Scotch gray stone moistened with water. If the work is not very fine, a piece of fine emery paper may be used in the same way. If it is coarse, a dead smooth file may be used. Another method is to secure emery cloth or paper to the end of a small round stick, placing the stick in the universal chuck of a lathe, holding the work against it with a light pressure, and moving it along while the lathe revolves.

(14) R. H. G. asks how to stain light colored wood a dark mahogany, cherry, or rosewood color, something that will not have to be applied hot. A. 1. Boil ½ lb. logwood in 3 pints of water, and add ½ oz. salt of tartar. 2. Boil ½ lb. madder and ¼ lb. fustic in 1 gallon water. 3. Boil 1 lb. Brazil wood and 1 oz. of washing soda in 1 gallon of water, apply, and then brush over it before dry a solution of 2 oz. alum in 1 quart of water. With these wood, if dry, may be stained in the cold; but the dyeing will be accomplished far more quickly and satisfactorily if the liquids are applied hot.

(15) J. W. writes: In placing a heater of a series of pipe in flue from boiler to stack, I circulate the feed water through and heat the water to say 50, 100, 150, 200, or 250° by thermometer, what saving per cent of coal should I have when thermometer indicates at the different figures, or does the saving vary at the different figures? A. In the use of heaters for the feed water of steam boilers the gain can be estimated by the following formula: $E = \frac{t' - t}{T - t}$, in which E is the economy or gain per cent, T total temperature (sum of latent and sensible heat) t—the temperature of feed water entering the heater, t' the temperature of water entering the boiler after passing through heater. Example: T = 1,200°, t = 50°, t' = 200°; then $E = \frac{200° - 50°}{1000°} = 0·15$, or 15 per cent gain.

(16) O. F. R. writes: I have 24 inches (miner's, 1 in. hole, 10 inches pressure of water). I have a 5 stamp mill, stamps weighing 480 lb. each, each stamp must drop 80 to the minute. What size overshot wheel and what size drums will it require to run the mill of 5 stamps, 80 drops to the minute, with 24 inches of water? A. To work the stamps would probably require 15 horse power = 495,000 foot lb. Allowing that an overshot wheel will give 60 per cent of the power of the fall, you would require a wheel about 30 feet diameter.

(17) J. A. H. asks: 1. Will three plain cylinder boilers, each 30 feet by 36 inches, with grate surface 6 by 9 feet, afford sufficient steam for two 110 h. engines? A. Yes. 2. Will a 30 horse engine doing 30 horse work require more steam than a 30 horse engine worked to its full capacity? A. Very little, scarcely appreciable. No more if the 30 horse is worked expansively to the best advantage.

(18) W. E. S. writes: I am about to construct a small steam skiff about 12 feet long by 2 in width; please inform me what size cylinders it will require to run it, provided I have one engine on each side of the wheel. A. Two engines, 2½ inches cylinder and 3 inches stroke.

(19) S. H. H. asks: 1. Which way will two engines, coupled together on the same crank or fly wheel shaft, give the most power, with the cranks quartered like a locomotive so there is no dead point, or set exactly opposite each other? A. There would be no difference in power, but set at right angles, will work steadier and better for all purposes.

(20) E. T. asks how to detect alum in bread. A. M. Buchner, a French scientist, discovered that a single drop of alcoholic extract of Campeachy wood, placed upon pure flour or bread, will cause a brownish yellow stain. If the flour contains alum, in the proportion of one or two per cent, the color will turn to a grayish blue or violet gray. With one half per cent of alum the tint is reddish yellow, with a border of gray blue, and small blue spots can be discovered by examining it with the lens. One fourth per cent of alum is the limit of reaction, when the blue border disappears, although the small spots are faintly discernible.

(21) J. A. G. asks: 1. How can I stop leaks in steam pipes? A. It depends entirely upon the metal of the pipes and character of the leak. If the pipes are defective they should be replaced. If the leak is due to poor fitting the only proper remedy is to do the work over. If the leak is due to unequal expansion the pipes must be re-arranged. 2. How many cells would be required to make a good magnet of a steel bar weighing about 1 lb.? A. About 4 cells of Bunsen battery. 3. Where can I find instructions for making a small magneto electric machine? A. In SUPPLEMENT, No. 161.

(22) G. S. L. asks what size boiler is needed for running small engine, 2 inch stroke by 1 inch bore. Also, can I heat the same by oil; if so, what kind of oil would be best for the purpose? A. Your boiler should have about 10 square feet of heating surface. You can run such a boiler with kerosene, but gas is much better.

(23) C. W. N. asks: How many pounds strain will the cogs on two wheels support, one wheel being 12 inches the other 7 inches in diameter (the strain being steady); size of cogs: length 1½, width at base ¾, width at top ⅝, depth ⅝; two cogs in mesh at a time? A. If the teeth bear fairly, one tooth 600 lb., two, 900 lb.; in actual use, not more than one-fourth these pressures should be allowed. 2. How much will a ⅝ wire cable chain support on a steady strain—how many pounds? A. For a short link chain made of ⅝ inch wire 6,700 lb.; and for wire rope ⅝ inch diameter, 4,000 lb. These are maximum working strains.

(24) W. S. J. writes: We have a tubular boiler, upright, 32 2-inch flues. The boiler is made of five-sixteenths iron, 24 inches diameter; length of flues 31 inches. What would be the safe working pressure for such a boiler? Is this size boiler large enough for a 4 horse power engine? A. If all other parts are equal to the strength of the cylindrical shell, 150 lb. The government rule would allow more. It is equal to 4 horse power with good fuel and a sharp draught.

(25) W. E. H. asks: 1. Is it practicable for me to convey power for my elevator (say 4 horse power) from a mill 500 feet distant by a wire rope? A. Yes, by dividing the distance and putting up an intermediate carrier shaft and pulley. 2. What size wheels and rope do I want? I know wire ropes are run in this vicinity for like purposes for short distances. A. A rope three-eighths or seven-sixteenths in diameter, on 4 foot pulleys, making 120 to 140 revolutions per minute, will be ample.

(26) B. and B. write: The suction pipe of a steam pump being 2½ inches inside diameter, the ends plugged up, how many holes of ⅛ inch in diameter should be put in the pipe (to serve as a strainer) to perfectly supply it with water? A. One hundred.

(27) L. P. L. writes: The mercury in my thermometer has separated. How can I remedy it? A. By gently jarring the separated portion down.

(28) J. G. R. writes: 1. I wish to make the small French battery used by physicians, called the French pocket battery. It uses some salt of mercury in the battery. A. You will find this battery described in SUPPLEMENT, No. 159. 2. How many layers, and what is the number of wire in the primary coil? Also, what is the number of wire in secondary, and how many layers? A. Primary, No. 20, 4 layers; secondary, No. 40, 10 or 12 layers. 3. What is the size of core and number of the iron wire? A. Core, ⅜ inch, composed of No. 24 iron wires. 4. How long, and how big round is the spool? A. 3½ inches long, 1 inch to 1¼ inches in diameter. 5. What is the salt used in the battery? A. It is proto-sulphate of mercury. 6. Of what does the negative pole consist? A. Zinc. 7. How heavy ought the armature iron to be? A. One or two pennyweights. 8. What are the proportions of peroxide of manganese and carbon in the porous cell of the Leclanche battery? A. About equal parts.

(29) M. N. asks: Suppose a thin band cylindrical or slightly conical, about the screw of a ship. Would not some of the force, wasted in moving the water in a direction perpendicular to the axis of the screw, be made useful in propelling the ship? A. Such bands have been tried repeatedly, but without advantageous results.

(30) A. W. J. asks how long a first-class air pump should hold its vacuum—air pump with single brass barrel? A. If pump valves, joints, and pipes be practically tight, for many hours.

(31) W. W. & S. ask how much difference is there between one ton hard coal and one ton soft coal in heating power? A. The evaporative power of good anthracite coal is rather higher than that of bituminous with suitably proportioned boilers. 2. Does it injure a boiler more firing with hard coal than soft? A. No, if the coal be free from sulphur.

(32) W. P. writes: I have a yacht 24 feet long, 6 feet beam, 2 feet deep; which I am going to run with a 6 horse power engine and 8 horse power boiler; intend it for pleasure and light towing in slack water. Am not so particular about speed as power. Will you please inform me in your valuable paper what sized propeller I need for this engine? A. Judging from the information given, we would say about 30 inches diameter and 3 feet pitch.

(33) J. L. asks: 1. Can the steam from an 8x12 be condensed in a cistern 8 feet wide and 16 feet deep? A. Yes, but you must have means of changing the water, as it would gradually get hot and become incapable of condensing the steam. 2. Would the water from the condensed steam be fit to be used again for the boiler? A. Yes. 3. How could I make an electric battery so as to run it with vinegar? A. A zinc and copper plate plunged into vinegar will generate an electric current, but it does not make a desirable battery.

(34) E. D. asks for a recipe for a black ink for use on the "copygram." Colored inks are prohibited in the army, and I know no place where labor can be saved to better advantage with a "copygram" than in the army, with its duplicates, triplicates, etc. I can take ordinary copying ink and get two or three impressions, but not entirely satisfactory ones. A. Try a strong aqueous solution of nigrosin, soluble aniline black.

(35) J. M. asks where the stone is found from which plaster of Paris is made. A. Gypsum is found in New York, Michigan, Virginia, Ohio, Canada West, Nova Scotia. The most important beds are those of the Paris basin at Montmartre.

(36) F. M. O. asks what materials, and the proper proportions of the same, are required to make what is now considered to be the best copying pad, with directions for mixing them. There have been so many receipts printed, that it is difficult to tell which is the best. I want to make one pad 10x12 inches. A. See page 205, Vol. 41, SCIENTIFIC AMERICAN.

(37) L. S. W. asks what the dimensions and the size and number of tubes of a boiler for a 5 horse power engine are, and have it plenty large enough; also, what would be the cost of such an one. A. Thirty inches diameter and 6½ feet high 40 or 42 tubes, 2 inches diameter and 48 or 50 inches long, cost about $250.

(38) F. S., referring to the electric machine described in SUPPLEMENT, No. 161, asks: 1. Would the power of the machine be increased any if made larger, say ½ or twice as large as the drawings given? A. Yes. 2. Is it necessary to have the bearings at each end of the armature secured to the sides of the magnet, and if not, will they have to be insulated from the base? A. The bearings of the armature may be secured to the base of the machine. They need not be insulated. 3. Will it do for the two arms of the magnet to be joined at the bottom? A. They may be joined by some non-magnetic material such as brass, rubber, wood, vulcanized fiber; but they should not be united or joined by iron or steel as the magnetic current would then be through the ends of the magnet and the connecting piece, instead of through the armature. 4. Would it do to have the commutator made of hard wood covered with rubber or gutta percha? A. Hard wood without the covering of rubber will answer very well.

(39) M. T. J. asks for the best method of magnetizing large size horseshoe magnets? If large quantity battery and electro-magnet is used please give proper proportions. A. The simplest method of magnetizing horseshoe magnets is to draw them from the bend to the poles across the face of an electro-magnet, breaking the current as the poles of the steel magnet come opposite the poles of the electro-magnet. This operation is repeated until the steel is fully charged. The electro magnet for this purpose should be about 6 inches long, with soft iron cores 1 inch in diameter wound with eight layers of No. 16 cotton covered copper wire. The battery should be 4 to 6 cells of Bunsen, which may be connected either for tension or quantity.

(40) E S F. writes: 1. I am making one of the telephones described in No. 142 of SUPPLEMENT. I should like to know what kind of wire I must use. Will No. 24 copper wire do? If not, what size shall I take? A. The size of wire is given in the article referred to. It should be No. 36 or No. 38 silk covered copper wire. No. 24 will not answer. If you make the telephone shown in Fig. 2, in SUPPLEMENT 142, you should make the spool as thin as possible, and the clamp which binds the magnets together should be of brass, rubber, wood, or some other non-magnetic material. 2. I am making in connection with this an electric call-bell, and I should like to know also if one bell of a common gravity battery will do? The distance between the telephones will be about 250 feet. A. See telephone calls, in SUPPLEMENT 163. One cell of gravity battery will do, if everything connected with the line is adapted to it; but it is preferable to use 2 or 3.

(41) C. E. asks (1) how to make a cheap magic lantern. Have a lens 2½ inches diameter and about 7 inches focal distance. A. You cannot make a very satisfactory instrument with a single lens, although you may use it for projecting very transparent slides on a small screen by arranging a box for containing the lamp and receiving the slides and making an adjustable tube for holding the lens from 5 to 8 inches from the slide. 2. How to silver glass for mirrors, say two or three inches square? A. For methods of silvering glass, see SUPPLEMENT 105.

(42) A. E. R. asks (1) how to make an Edison transmitter? A. See SUPPLEMENT 163, for a full description of Edison's transmitter. 2. I have made an Edison transmitter, but it does not work to perfection, it seems to be loud enough but it "buzzes." Can you tell me the cause? I use a carbon taken from a common carbon battery. Is there anything better? A. Use lampblack collected from the chimney of a petroleum lamp. 3. I have read that the primary wire of the induction coil should be on the outside, but I have mine on the inside: which is correct? A. Either will do. 4. Is there a spring used in a transmitter, and if so, for what purpose? A. There is no spring in Edison's transmitter.

(43) P. H. B. writes: I am thinking of putting up a telephone with another room. Will you please describe the most easily made receiver and a transmitter that will transmit, perfectly and distinctly, words spoken in a moderately low tone? I would like to have the transmitter made to appear from without, somewhat like the one that looks like a small box, with the diaphragm in the center of the door. The greatest distance that the telephones will have to work is about 150 to 200 feet. Please also tell me if, for this distance, there is an instrument that will take the place of both receiver and transmitter, and will transmit speech nearly as well? A. The Blake transmitter described on p. 274, Vol. 41, SCIENTIFIC AMERICAN, would answer your purpose. One of the telephones described in SUPPLEMENT 142 will answer as a receiver. It is probable that some of the best forms of magneto-telephones would answer both as transmitter and receiver, but you will get better results by using a transmitter and a battery.

(44) D. P. D. asks: What is the difference between the velocipede and tricycle? The derivation of the latter and bicycle tells me the one has three wheels, the other two. But what the velocipede is in contradistinction to the other two is unknown to me. A. The word velocipede means swift foot, and applies properly to two, three, and four-wheeled vehicles propelled by foot.

(45) W. H. S. asks: 1. Does the copper wire wound on a horseshoe magnet require to be insulated? A. Yes. 2. What batteries will be required and what sized magnet to lift twenty pounds? A. Use two cells of Bunsen battery. Make the magnet four inches long with half inch cores, and wind with eight layers of No. 18 cotton or silk covered wire.

NEW BOOKS AND PUBLICATIONS.

THE FARMER'S FRIEND AND GUIDE. Frank Harrison & Co 206 Broadway, New York city. Price 50 cents.

A quarto volume of 232 pages of matter carefully selected from leading publications at home and abroad, pertaining to farming, stock raising, poultry, bee culture, gardening, etc.

JAPANESE ORNAMENTATION. Jesse Haney & Co., New York.

This is a handsome quarto volume containing a great number of Japanese designs useful for painters and decorators, and entertaining to everybody.

THE HOUR.

This is the title of one of the best edited and most interesting literary newspapers that comes to this office, and our exchange list numbers more than three thousand different publications. *The Hour* was started at the commencement of this year, by W. P. Talboys and two or three other gentlemen well known in literary and art circles, and within the short time it has been published it has met with a good degree of success. The editorials are carefully written and the subjects judiciously selected. *The Hour* has appropriately a minute-and-second department, in which as the title implies, the topics of the day, society news, and other items of interest are skillfully served up in short paragraphs. Published weekly, at 38 University place, New York city. Terms, $4 per annum, single copies 15 cents.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 30, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Air engine, J. Ericsson 226,030
Alloy, manufacture of nickel zinc, T. Fleitmann 225,977
Animal trap, G. W. & I. B. Roberson 225,948
Auger, hollow, J. H. Smith (r) 9,130, 9,131
Axle, car, P. C. Plant 225,908
Back band hook and buckle, S. Ward 226,125
Balances, attachment to, Le Noir & Chunn 226,068
Barrels for white alcoholic liquors, manufacture of, H. De Bus 226,044
Bathing attachment for piers, L. Kirkup 225,980
Bed bottom, J. Bowen 226,020
Bed frame, T. L. Odell 225,930
Blacksmith's shears, W. S. Reeve 226,116
Bolt heading and pointing machine, A. Magnuson 226,090
Books with metallic staples, machine for stitching, C. Lieb 226,085
Boots and shoes, sand paper roll for, Rathbun & Adams 226,104
Box, H. W. Goodnow 225,978
Braid holder, D. Goff 226,063
Brick and tile machine, J. W. Penfield 225,936
Brick for evaporating pans, G. W. Russell 226,174
Brick or building block, and method of laying the same, J. Perchment 225,945
Broom head, J. R. Spencer 226,134
Burglar alarm, G. W. Cooley 225,972
Button, H. Wessel 225,960
Button and necktie fastener, collar, H. Hickman 226,071
Buttons, die for forming, C. R. Wickes 226,140
Car, cattle, W. C. Alston 225,911
Car, convertible grain, C. C. Coffin 225,918
Car coupling, A. Guyer 225,981
Car coupling, P. H. Wandel 226,139
Car propeller, street, W. F. Rothenberg 226,102
Car, railway, C. Barrett 225,963
Car, stock, J. Hay 226,068
Car, stock, S. P. Tallman 226,131
Carburetor, I. A. Hyams 225,931
Carbureting apparatus, G. Smyers 226,128
Caoutchouc, etc., making goods from, H. Gerner 226,064
Caoutchouc, treating waste vulcanized, L. Hoyer 226,020
Carriage, child's, E. B. Welch 226,136
Carriage clips, roll for forming, J. C. Richardson 226,109
Carriage jump seat, J. Finnegan 225,973
Carriage spring, O. C. Coggins 225,970
Carriages, extension bow iron for, J. W. Anderson 226,015
Cartridge, J. Suget 226,117
Chair seat, J. Lemman 225,993
Check register, J. Crawford 225,920
Clevis, E. Wansbrough 226,137
Clock movement, calendar, W. L. Bundy 225,969
Clothes hook, P. Miles 225,943
Clothes line adjusting device, K. Weber 226,306
Combustion, promoting, B. F. Sherman 226,120
Commode, W. J. Winghart 226,003
Corn, implement for shocking, W. C. Tullis 226,136
Corsets, manufacture of, J. C. Tallman (r) 9,137
Cotton press, A. Tompkins 226,182
Cylinder engines, triple, F. A. Gardner 226,155
Dental burrs, sharpening, M. A. Richardson 226,110
Door spring, I. S. Davis 225,972
Drill, J. L. Bryant 226,145
Easel, I. Wilkins, Jr 226,139
Elevator, B. H. Keyes 226,077
Elevator, C. R. Otis 226,150
Elevators, operating, R. Dunbar 226,042
Emery wheel, G. Hart 226,166
Envelope machine, A. A. Rheutan 225,947
Extinguisher, E. Mercier 226,095
Fan, automatic, J. Warener 226,144
Farm gate, J. F. Potter 226,102
Feed water apparatus, C. M. Wilcox 226,141
Feed water apparatus for steam boilers, H. Bergstrom 226,021
Feed water apparatus for steam boilers, J. C. Stead 225,006
Feed water for boilers purifying, S. J. Hayde et al. 226,066
Fence wire, machine for manufacturing metallic barbed ribbon for, A. Cary 226,034
Fertilizers, force feed distributor for, Sheldon & Peacock 226,121
Filling and packing machine, J. McCrudden 225,940
Firearm safety lock, Needham & Hinton 225,994
Fish, preserving, C. Mare 225,936
Flue and shield, chimney, A. T. Jackson 226,074
Flue cleaner, steam, R. Atherton (r) 9,138
Flywheels, retaining and releasing device for, G. S. Romminger 226,113
Folding chair, S. G. McCullough 226,092
Folding chair and settee, J. R. Wakefield 225,957
Foot bath, J. S. Hagerty 226,052
Game apparatus, F. C. Zanetti 226,145
Gas retorts with hydrogen oils, charging, A. Riebeck 226,081
Gearing, endless belt, J. Parr (r) 9,135
Generator and motor, J. E. Culver 226,161
Glass, brush wheel for polishing, D. Forbes 226,164
Grain binder, H. Chamberlain 226,035
Grain binder, M. T. Neale 225,946
Griddle, C. F. Green 225,987
Hair wash, M. Goldman 225,979
Hand rakes, manufacture of, J. W. Ells 226,051
Harness loop fastening, J. Shaffer 225,979
Harness loops, manufacture of, J. Shaffer 226,104
Harvester rake, O. Cooley 225,971
Hat brims and bands, making, J. E. Peters 225,936
Hat holder, G. W. Lindsey 226,087
Hat press, M. A. Cuming 226,041
Hay knife, A. Zimmerer 226,146
Hay rake, horse, C. B. Holden (r) 9,133
Hinge, Green & Roberts 225,980
Hinge, lock, M. L. Cummings 226,042
Hoe, J. W. Ells 226,050
Horse powers, spring draught attachment for, A. E. Morris 226,097
Hose carriage, J. B. Allen 226,012
Hose, manufacture of rubber lined, R. Cowen 226,036
Hydrant, J. P. Kenyon 225,984
Hydraulic motor, J. Thomas 226,138
Iron and steel, manufacture of, J. A. Jones 225,932
Iron in the puddling process, dephosphorizing, W. A. O. Wuth 226,143
Key fastener, D. D. Barton 226,016
Kneader and flour sifter, combined dough, I. W. Lincoln 226,085
Knitting machine, circular, W. H. Mayo 226,094
Knob attachment, A. M. Smith 226,123
Lace show box, J. Loeb 226,088
Lamp, O. Knapp 225,935
Lamp, D. R. Lowden 226,089
Lamp burner and chimney, H. W. Hayden 225,929
Lantern, L. Henkle 225,988
Lathe, Davies & Chidester 225,971
Lathing and plastering, W. J. Garvey 226,154
Line fastener, H. Fenton 225,931
Locomotive exhaust nozzle, J. E. Martin 225,937
Lubricator, Hodges & Parshall 225,985
Meat, preserving, H. Warden 226,138
Medical compound, W. I. Lewis 226,084
Metallic hoop, E. Hain 226,066
Mower, J. D. Wilber 225,961
Mower and reaper knife, D. F. Sutton 226,129
Mower and reaper knives, machine for sharpening, J. M. Connel 226,037
Mower cylinders, device for facilitating the drilling of, J. Braun 225,966
Mower cylinders, device for facilitating the riveting of cutters to, J. Braun 225,967
Musical instrument, stringed, W. H. Percival 225,997
Nail assorting machine, O. P. Cobb 226,019
Nailing machine, L. Goddu 226,061
Necktie, C. C. Hancock 225,982
Nozzle, spray, C. E. Glazier 226,060
Oil from metal chips, mechanism for extracting, C. F. Roper 225,949
Oiling steam valves, device for, G. W. Baker 225,912
Paddlewheel, feathering, Pratt & Lewis 225,999
Padlock, permutation, G. M. Hathaway 226,069
Pail or tub cover, E. Rice 226,111
Painter's stand, carriage, J. H. Frey 225,936
Paper bag machine, E. B. Stocking 226,127
Paper box machine, G. Boyce 225,915
Paper cutter, E. Leger 225,990
Paper feeding machine, F. Rosshert 225,951
Paper pulp engines, bed plate for, G. Morse 226,099
Paper pulp from wood, making, G. D. King 225,986
Paper pulp, machine for preparing, G. H. Ennis 225,976
Paper pulp, wood grinder for making, S. M. Allen 226,013
Paper pulping engine for the reduction of wood, straw, etc., W. E. Farrell 226,052
Peanut roaster, T. Lee 226,081
Pen, stylographic fountain, C. Baer 226,014
Photographic apparatus, T. H. Blair 226,023
Planter check rowing attachment, corn, R. W. Johnson 225,986
Planter, corn, M. Runstetler 226,115, 226,116
Plow, sulky, B. C. Bradley 226,027
Pocketbook, coin, J. W. Meaker 225,998
Post hole digger, J. Schneider 226,118
Preserving fruit, D. M. Mefford 226,094
Printing machine, chromatic, J. H. Shiffer 225,951
Printing machine inking fountain, Z. R. Bennett 225,964
Pulley apparatus, differential, W. H. Thompson 225,953
Pump, G. F. & W. G. Beebe 226,018
Pump, T. G. Hoster 225,930
Pump, W. S. McLeod 226,092
Pump, J. A. Sinclair 226,030
Pump, force, H. Reece 225,946
Pump, submerged, W. G. Beebe et al. 226,019
Pumping system, C. Tyson 226,138
Railway rail, R. N. Allen 225,909
Railway rail, M. G. Egbert 226,044
Railway signal, electrical, A. Wrigley 225,961
Refrigerator, L. Laisotte 225,992
Refrigerator, J. Matthews (r) 9,132
Rocking chair, folding, J. R. Wakefield 225,956
Rubber and other gum compounds for surfacing cloth and for other purposes, India, C. Y. Beach 226,017
Rubber, etc., treatment of India, H. Gerner 226,057
Saddle, gig, Leonhart & Werle 226,079
Sails, hoisting storm, S. P. Willeby 226,142
Sash cord guide, F. S. Clarkson 225,969
Sash fastener, C. M. Burns, Jr 226,028
Sash holder, J. B. Yeagley 226,147
Saw frame, buck, W. H. Hankin, Jr 225,933
Saw, scroll, O. F. Sutton 226,130
Sawing machine, drag, C. Hagerty 226,064
Scales, portable weighing, W. W. Reynolds 226,110
Scales, weighing, R. F. Dobson 226,046
Scissors and shears, L. Strauss 226,129
Sewing machine, E. T. Thomas 225,954
Sewing machine, tension device, G. A. Brady 226,026
Shaft support, vehicle, D. A. Epperson 226,149
Shirt, J. S. Lester 226,080
Shutter worker, R. J. Dickerson 226,045
Sliding and swinging gate hanger, B. A. Rice 226,112
Snap hook, C. B. Bristol 226,029
Snow clearer for railway tracks, rotary, J. W. Close 225,917
Soda fountain, A. D. & L. W. Puffer 226,103
Spinning and twisting machine, thread board and guide for, J. C. Stanley 226,126
Spinning mule, self-acting, H. Hendry 225,984
Spur, A. D. Tytler 225,955
Square, try, H. Johnson 226,075
Stalk rake, revolving, H. Speer 226,062
Stamp, hand, J. Leighton 225,988
Staples and securing them in paper, mechanism for forming wire, C. H. Kellogg 225,988
Steam boiler, L. McKay 225,941
Steam generator, C. Holland 226,072
Stone, compound for artificial, A. K. Lee 225,991
Stove, oil, J. M. Whitmore 226,001
Stove shelf, Sprey & Bush 226,125
Stoves, hot water attachment for magazine, C. Johnson 225,987
Street sprinkler, J. N. Schureman 226,119
Sugar, apparatus for liquoring lump, E. Langen 226,078
Sugar, centrifugal apparatus for liquoring hard, F. O. Matthiessen 225,939
Surface gauge, A. Schilling 225,950
Surgical splints, felting for, W. H. Johnstone 226,076
Switch lock, J. W. Reinhart 226,107

Tap, J. T. Hayden 226,067
Tap bushing and valve, combined, K. C. Gillette.. 226,020
Tether, K. H. Angell 226,016
Thill adjuster, E. Covert 226,049
Thill coupling, C. T. Brockett 226,032
Thill coupling jack, Best & Higgins 226,031
Thill couplings, anti-rattler for, E. Ely 226,063
Tire upsetting machine, N. S. Cary 225,985
Tower, extension, D. M. Pfautz 226,171
Truck, M. A. Reynolds 226,136
Umbrellas, machine for forming and tempering paragon ribs for, C. H. Morgan 225,943
Vegetable cutting and grating machine, W. Mild. 226,026
Vehicle dash rail, A. Z. Dods 226,025
Vehicle spring, C. M. Blydenburgh 226,065
Vehicle spring, G. N. French .... [illegible]
Wagon bodies, device for elevating, D. Booker... 226,036
Washing apparatus, W. B. Le Noir (r) 9,156
Water elevator, T. J. Adams 225,980
Water meter, C. H. Bacon 226,161
Water meter, A. Buckley 226,183
Waterproof fabric, F. Brigham et al 226,032
Weighing and transferring apparatus, grain, E. S. Richards 226,128
Whiffletree clip, L. W. Frederick 225,924
Windmill, T. Bright 226,040
Windmill, O. Colvin 226,036
Yoke, neck, P. J. Vehlen 226,134

DESIGNS.

Carpet, H. Horan 11,710
Carpeting, E. Poole .... 11,711 to 11,713
Curtain pole, J. Berbecker 11,709
Draught stand for aerated and other beverages, F. H. Shepherd 11,711
Horse block, W. Eddy et al 11,700
Jewelry pendant, F. Dunier 11,716
Spurs, A. Buermann 11,715

TRADE MARKS.

Asphalt, crude, or crushed, or otherwise manufactured, also mastic or any other compound of asphalt with bitumen, or other substance, also pavements made wholly or partly from the same, Neuchatel Asphalt Company 7,909
Medicinal preparations, certain, A. A. Solomons 7,902
Paper for checks, bank notes, promissory notes, drafts, bills of exchange, etc., safety, H. M. Walker 7,903
Tobacco, fine cut chewing, Simrall & Crawford 7,901
Watches, L. Straßburger & Co. 7,903, 7,904
Yarns, fancy, Middleton, Ainsworth & Co. 7,909

English Patents Issued to Americans.

From March 26 to March 30, 1880, inclusive.

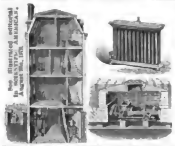
Beer drawing apparatus, A. J. Spencer, San Jose, Cal.
Bending metal strips for tubes, apparatus for, J. Heaven, Norristown, Pa.
Horseshoe machinery, T. S. Very, Boston, Mass.
Ice making machinery, C. M. Tessie et al., N. Y. city.
Motor, electro-magnetic, W. W. Griscom, Phila., Pa.
Motor, electro-magnetic, W. W. Griscom, Phila., Pa.
Separating liquid from solid matter, machine for, S. S. Hepworth, Yonkers, N. Y.
Smelting ovens, R. P. Wilson et al., New York city.
Springs, compound and apparatus for making, N. Jenkins, New Haven, Conn.
Telephones, E. Marz et al., New York city.

Founded by Mathew Carey, 1785.

BAIRD'S BOOKS FOR PRACTICAL MEN.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo; a Catalogue of Books on DYEING, CALICO PRINTING, WEAVING, COTTON and WOOLEN MANUFACTURE, &c; Catalogue of a choice collection of PRACTICAL, SCIENTIFIC, and ECONOMIC BOOKS, &c; List of Books on STEAM AND THE STEAM ENGINE, MECHANICS, MACHINERY, and ENGINEERING, &c. List of Important Books on METALLURGY, METALS, STRENGTH OF MATERIALS, CHEMICAL ANALYSIS, ASSAYING, etc. &c; List of Books on MINING, MINING MACHINERY, COAL, etc., &c; two Catalogues of Books and Pamphlets on SOCIAL SCIENCE, POLITICAL ECONOMY, BANKS, POPULATION, PAUPERISM, and kindred subjects; a Catalogue of recent additions to our stock of PRACTICAL SCIENTIFIC AND TECHNICAL BOOKS; as well as a List of LEADING BOOKS on METAL MINING, METALLURGY, MINERALOGY, ASSAYING, AND CHEMICAL ANALYSIS, sent free to any one who will forward his address

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.



THE HOLLY SYSTEM FOR HEATING cities and villages, under the Holly Patents, is in practical operation in many places. For economy, comfort, and convenience is superior to any other principle. Licenses granted to corporations for the use of this system. Holly Steam Combinat'n Co., Lim., Lockport, N.Y.

50 Gold, Chromo, Tortoise, Scroll, Marble, and Bow CARDS, 10c. SEAVY BROS., Northford, Ct.

PENNSYLVANIA LAWN MOWER.

Surpassing all others, and pronounced the best.

1880  1880

ADVANTAGES.

Lightness combined with strength.
Runs more easily
Will cut longer grass.
Is more durable.
Requires less repairs.
Cuts grass more smoothly.
Less liable to obstruction.
Easily adjusted
No springs. Almost noiseless.

Every Mower warranted.

LLOYD, SUPPLEE & WALTON, PHILADELPHIA.

MACHINERY FOR SALE.
Three large lathes, also, one large planer. For particulars, address THE HARTFORD FOUNDRY AND MACHINE CO., J. B. HUNTER, Prest., Hartford, Conn.

PEERLESS

Damper Regulator.

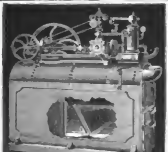
Superior in every respect to all other regulators. The greatest fuel-saving appliance ever invented. Insures safety from explosion. In ordering mention steam pressure. Illus. catalogue sent on application. We set it up and guarantee performance. Price, $75.00.

AMERICAN STEAM APPLIANCE CO.
13 & 15 Park Row, SOLE MANUFACTURERS, New York.

AMERICAN JOURNAL OF INDUSTRY

Most widely circulated industrial journal in the Union. Try it three months, only $1.00. Advertisements and illustrations published at remunerative rates.
JOURNAL OF INDUSTRY CO., Pittsburg, Pa.

Elegant Autograph Album, gilt covers, 48 pages, illustrated with birds, scrolls, etc., in colors, and 47 Select Quotations, 15c. Agents' Outfit for Cards (over 60 samples), 10c. DAVIDS & Co., Northford, Ct.



PORTABLE AND STATIONARY ENGINES and Boilers, 2½ to 15 H. P. Return Flue Boiler, large fire box, no sparks. Do not fail to send for circular to SKINNER & WOOD, Erie, Pa.

THE

MOSS ENGRAVING CO.,

(MOSS'S NEW PROCESS,)

535 PEARL STREET, COR. ELM,

ONE BLOCK FROM BROADWAY,

JOHN C. MOSS, Supt. NEW YORK.

MR. JOHN C. MOSS, having disposed of all his interest in the PHOTO-ENGRAVING Co., 67 Park Place, has arranged with this Company to superintend its operations, which will be conducted on an extensive scale under the improved process recently invented by him, which is greatly superior to the old. The lines are much deeper, and the cost of production much less.

OUR MOTTO IS

"THE BEST WORK AT LOW PRICES, ALWAYS ON TIME."

Parties having engraving to do, will find it to their interest to give our NEW METHOD a trial.

Inside Iron Strapped Block. Wrought Iron Block. Patent Iron Sheave Steel Roller Bushed.

Pulley Blocks.
Iron Sheaves. Phosphor Bronze Self-Lubricating Bushings. PENFIELD BLOCK WORKS. Lock Box 50, Lockport, N. Y.

Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

AGENTS Catalogue free. $7 per day made easy. J. F. GAGE & CO., Boston, Mass.

THE STRONGest, most complete, and reliable of Engines and Boilers. Special sizes, 4 to 40 H. P. Others on application. Also jointless steam kettles and machinery generally. Geo. W. Tift, Sons & Co., Buffalo, N. Y.

JOHN R. WHITLEY & CO.
European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E.C. Paris, 8 Place Vendome. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

Grain Speculation

in large or small amounts. $25 or $25,000. Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., CHICAGO, ILL., for Circulars.

SPARE THE CROTON AND SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N. Y., who control the patent for Green's American Driven Well.

TRIUMPH MIDDLINGS MILL.

Under Runner, Iron Frame.
Mills changed from old to new process.
WILCOX, SHINKLE & MILLER,
Mill Furnishers,
PITTSBURGH, PA.
Established in 1848.

RUBBER BACK SQUARE PACKING.

BEST IN THE WORLD.

For Packing the Piston Rods and Valve Stems of Steam Engines and Pumps.

B represents that part of the packing which, when in use, is in contact with the Piston Rod.

A the elastic back, which keeps the part B against the rod with sufficient pressure to be steam-tight, and yet creates but little friction.

This Packing is made in lengths of about 20 feet, and of all sizes from ¼ to 2 inches square.

JOHN H. CHEEVER, Treas. NEW YORK BELTING & PACKING CO., 37 & 38 Park Row, New York.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.

DAVID W. POND, Worcester, Mass.

SWEEPSTAKES, WITH THE ELLIS Patent Journal Box. The best Planer and Matcher ever made. Planing 20 in. wide, 6 in. thick, weight 2,100 lbs., $350; planing 24 in. wide, 8 in. thick, weight 2,800 lbs., $—. Banding, Arbor and Head, extra $— . Sash, Door, and Blind Machinery a specialty. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

CATARRH Successfully Treated and Permanently CURED in every case. No Pay till Cured. Dr. J. K. ROSS, CENTREVILLE, IND.

An engine that works without Boiler. Always ready to be started and to give at once full power.

SAFETY. ECONOMY. CONVENIENCE.

Burns common Gas and Air. No steam, no coal, no ashes, no fires, no danger, no extra insurance. Almost no attendance.

THE NEW OTTO SILENT GAS ENGINE.

Useful for all work of small stationary steam engine. Built in sizes of 2, 4, and 7 H. P. by SCHLEICHER, SCHUMM & CO., 3045 Chestnut Street, Phila., Pa. H. S. Manning & Co., 111 Liberty St., N. Y., Agents.

XX COT (not painted.) White Duck $2.

Makes a perfect bed. No mattress or pillows required. Better than a hammock, as it fits the body as pleasantly, and lies straight. Folded or opened instantly. Self-fastening. It is just the thing for hotels, offices, cottages, camp-meetings, sportsmen, etc. Good for the lawn, piazza, or "coolest place in the house." Splendid for invalids or children. Sent on receipt of price, or C.O.D. For 50 cts. extra, with order, I will prepay expressage to any rail road station east of Mississippi River and north of Mason and Dixon's line. For 75 cents, in Minnesota, Missouri, and Iowa.

HERMON W. LADD, 108 Fulton St., Boston; 207 Canal St., New York; 165 North Second St., Philadelphia. Send for Circulars.

FREE Illustrated CATALOGUE of 1 Ct. Chromos, Watches, Revolvers and Novelties. CHEAPEST & largest assortment in the U. S. E. F. NASON, 111 Nassau St., N. Y. SONGS

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

B. W. PAYNE & SONS, CORNING, N. Y.

ESTABLISHED 1840.

Patent Spark-Arresting Engines, mounted and on skids. Vertical Engines with wro't boilers. Eureka Safety powers with Sectional boilers—can't be exploded. All with Automatic Cut-Offs. From $150 to $2,000. Send for Circular. State where you saw this.

ROCK BREAKERS & ORE CRUSHERS.

(THE "BLAKE" STYLE.)

This machine has for twenty years stood the TEST, and found to be the *best* one made for breaking all kinds of hard and brittle substances, such as ORES OF ANTE EMERY, etc., etc.

Mr. S. L. Marsden, for the past twenty years connected with the manufacture of this machine, superintends its manufacture.

FARREL FOUNDRY AND MACHINE CO., Manufrs., Ansonia, Conn.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
235 BROADWAY, NEW YORK.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.

NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

ROOTS' NEW IRON BLOWER.

POSITIVE BLAST.

IRON REVOLVERS, PERFECTLY BALANCED

IS SIMPLER, AND HAS

FEWER PARTS THAN ANY OTHER BLOWER.

P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 8 Dey Street,
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street,
NEW YORK.

SEND FOR PRICED CATALOGUE.

Furnace Hoist.

ELEVATORS.

All kinds of Hoisting Machinery a specialty. Steam, Hydraulic, and Belt Power for Passengers and Freight. Iron Furnace Lifts, Portable Hoists. STOKES & PARRISH, 30th and Chestnut St., Phila. Pa.

SALESMEN WANTED $125 A Month and Expenses selling to DEALERS. SAMPLES FREE. Send 3c. stamp to CIGARS C. FOSTER & CO., Cincinnati, O.

$777 A YEAR and expenses to agents. Outfit Free. Address P. O. VICKERY, Augusta, Maine.

52 Gold, Crystal, Lace, Perfumed, and Chromo Cards, name in Gold & Jet 10c. Clinton Bros Clintonville, Ct.

CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 20, 1866, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.

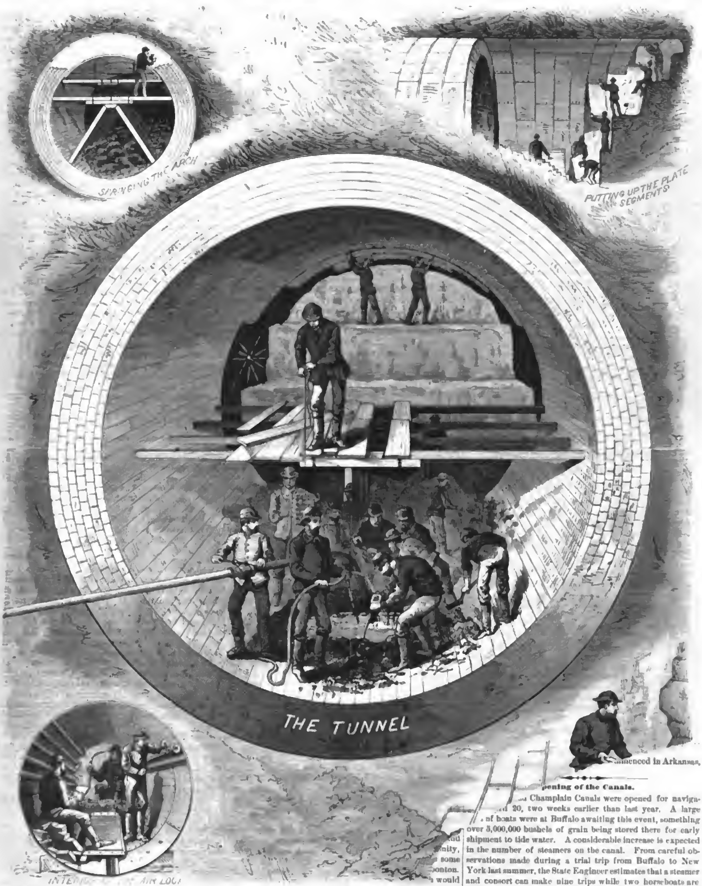
BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 19. [NEW SERIES.] | NEW YORK, MAY 8, 1880. | [$3.20 per Annum. [POSTAGE PREPAID.]



THE GREAT TUNNEL UNDER THE HUDSON RIVER BETWEEN NEW

...nd ...nity, ... some ...onton. ...h would ...ever, to ...nto print ... had been

...enced in Arkansas,

[O]pening of the Canals.

... Champlain Canals were opened for naviga... ...il 20, two weeks earlier than last year. A large ... of boats were at Buffalo awaiting this event, something over 3,000,000 bushels of grain being stored there for early shipment to tide water. A considerable increase is expected in the number of steamers on the canal. From careful observations made during a trial trip from Buffalo to New York last summer, the State Engineer estimates that a steamer and consort can make nine trips while two horseboats are making seven, at a cost nearly $500 less. Counting this saving, with the profit on the two additional trips, the gain for the steamer and consort during the season would be $1,352, without considering return cargoes.

THE TUNNEL UNDER THE HUDSON RIVER.

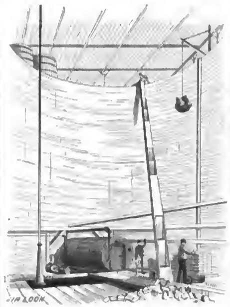
This great undertaking, which has been a conception of engineers and the talk of speculators for many years, is at last fairly under way, and our illustrations in this number give a good idea of the manner in which the work is being carried on. One would think that the great railroad lines terminating in Jersey City would give the project of a tunnel under the Hudson their hearty support, but some of them have opposed the plan from its inception, on account of the large amounts of capital they have invested there in the way of docks, storehouses, and depots, and in boats for the transportation of passengers and freight, and possibly, also, from jealousy of each other, lest one should obtain greater advantages than another. For this reason the work on the tunnel, which was commenced about 6 years ago under the laws of New York and New Jersey, has been greatly impeded by tedious litigation. It is supposed, however, that all obstacles of this nature are now removed, and substantial progress is at present being made. The work is carried on by the Hudson Tunnel Railroad Company; capital, $10,000,000; Dewitt C. Haskin, President and Active Manager; Secretary, L. C. Fowler; Engineers in Charge, Spellmann & Brush; Consulting Engineer, Col. Wm. H. Paine; Superintendent, J. F. Andersen. We are under obligations to all of these gentlemen, especially to President Haskin and Engineer Brush, for facilities in examining the works and for particulars.

The commencement of the work was made by sinking a perpendicular shaft or well, 30 feet in diameter by 60 feet deep, at a distance of 100 feet from the water, at the foot of Fifteenth street, Jersey City. This shaft is built in a solid manner, and lined with a 4-foot brick wall. The bottom of the shaft is the level of the roadway of the tunnel when the latter is completed, but the work toward the river was started at about half the depth of the shaft, the tunnel thence descending, by a series of steps, till it reaches the grade intended. This, of course, is only a temporary device, but it gives an easy grade at the commencement, which facilitates the furnishing of supplies or material for building the tunnel, and that portion of the shaft below the present entrance is now used as a great receiving cistern, into which is forced water and silt from the head of the tunnel.

The manner in which this tunnel is being built differs from anything heretofore attempted in this line, in that the principle is adopted of using compressed air to keep out the water, and partially to uphold the earth. At the commencement of the work, while the tunnel was being excavated through made ground, consisting largely of cinders, it was found impossible to maintain the required pressure, as the air escaped through the loose material. This difficulty was obviated by placing canvas several feet below the surface; but as the tunnel descended the earth was found sufficiently compact to render this unnecessary. The air pressure now used in the tunnel is from 17 to 20 pounds per square inch. The iron plates which form the exterior shell of the tunnel are rapidly put in, so that the workmen at the heading will always be protected by an iron ceiling, and thus the earth above the tunnel is furnished with a support almost as soon as an excavation is made.

The tunnel is nearly round, and its shell is an iron cylinder, about 22 feet high by 20 feet broad, made of boiler iron and worked forward in sections, as shown in our engravings. This iron is ¼ inch thick, and the plates are 2 feet 6 inches wide; some of them are 3 and some 6 feet long, and they have 2½ inch flanges on each side, through which each plate is bolted on all four sides to those around it. Additional strength is attained by the breaking of joints as the different sections are bolted together, the width of the plates, 2 feet 6 inches, forming the width of the several sections or ribs by which the cylinder, which constitutes the framework of the tunnel, is advanced. Inside this outer shell is a wall of hard-burnt brick, laid in cement; this wall, or lining, is 2 feet thick, and, extending completely around the interior, presents the form of an arch against any outside pressure, whether vertical or lateral.

In the prosecution of the work the men at the heading first dig and spade forward a thin semicircular opening, representing about the size and shape of the top of the tunnel, leaving the core or main portion of the earth untouched, only excavating sufficiently to allow the top plates to be placed in position, where they are bolted and braced before the earth beneath is taken out. In proceeding on this plan the work, as it progresses, shows four to eight sections, or widths of plates, in different stages of completion, the most advanced ones being extended out as a kind of hood, well braced up, until all of the earth in this core be removed, and the plates are put in position around all sides of the shell. After this is done the bricklayers follow, and, in making their two foot thick lining to this shell, are careful to lay the wall to fit close and solid to the plates, to which it is anchored by the 2½ inch flanges in the latter. This work and that being done at the heading is illuminated by an electric light, which enables the workmen to see what they are doing as well as if they were above ground.



THE AIR LOCK.

The removal of the earth taken out has thus far been a very easy task. It is a tenacious mixture of blue clay and sand, the latter markedly from a gneiss formation of rock. As taken from the heading it is puddled with clear water pumped in from a stand pipe in the shaft at the mouth of the tunnel, and is then forced out through a 6-inch pipe by the air pressure in the tunnel. It is thought that this material will make excellent brick, and arrangements are now being made to use it for that purpose on ground adjacent to the tunnel opening for the supply of the immense amount of brick that will be needed in the work.

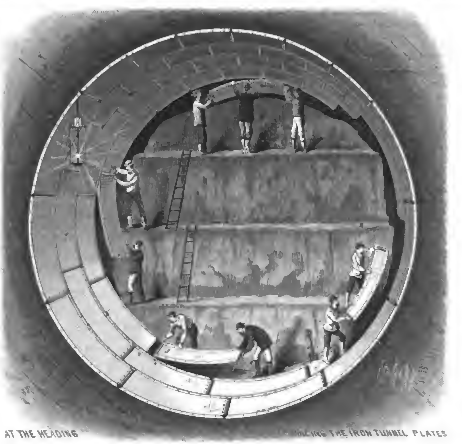
The air lock, at the mouth of the tunnel, is made of boiler iron, is 6 by 15 feet in size, and appears much like an ordinary steam boiler. Twenty men can easily be passed through at a time; and a narrow railway track runs through it, on which a car with brick and other materials for the work is run into the tunnel. When the lock is closed on the outside the inner door opening into the tunnel is open, and communication is now had with the workmen in the interior by placing written messages against a plate glass window in the outer end, when they can be read from the inside; this is to be superseded, however, by a telephone. In the interior of the air lock are what are called "equalizing" pipes, for regulating the air pressure in harmony with that in the tunnel, as may be desired. The operation of the air lock is extremely simple: on entering the tunnel one steps into it as in a sort of ante-chamber, where it would be dark were it not for such light as is given by a candle; the inner door, connecting with the tunnel, is, of course closed, and, when the outer door is closed the compressed air is gradually let into the lock, either from the tunnel itself or from the air reservoir. From five to ten minutes is generally taken for this purpose, so that the change will not be too sudden, and particular care is taken in this respect when those who have never been in before are entering the tunnel. One of the foremen, however, went through the lock in two minutes a few days ago, and the men employed in the work seem to suffer no inconvenience or disagreeable effects from the changes in pressure of the air, either in going in or coming out. The pressure used here is considerably less than was employed in the building of the foundations for the East River Bridge.

The supply of pure air and the careful regulation of the pressure are, of course, most important essentials in a work of this kind. There is an engine especially to run the compressor, which is worked in connection with an outside air reservoir, 5 by 11 feet in size, and a ventilating pipe in the tunnel secures a constant circulation of fresh air from the surface. There are three sets of workmen, each set composed of about forty men, and working eight hours daily, so that the work proceeds day and night throughout the twenty-four hours. At present the work is progressing at the rate of three feet per day of finished tunnel; but the facilities for construction will soon be increased, and in three years the tunnel is expected to be complete.

At present, the work has been carried forward about 150 feet from the shaft, or a distance of some 60 feet under the river, beyond the dock. The water here is shallow, and the top of the tunnel where they are now working is about 25 feet below the bottom of the river. The width of the river on the line of the tunnel is 5,500 feet, and it gradually deepens all the way from the Jersey shore till within about 1,000 feet of the New York side, where the water is 60 feet deep, and the bottom changes from sand and clayey silt to one of rock. The grade of the tunnel will follow in a general way the gradual drop in the bottom of the river, and will ascend rather more abruptly on the New York side. The tunnel now building is only one half of what is to make the completed work, as the design is to have two tunnels side by side, under the river, which will be carried into one larger tunnel at the shore ends; the second tunnel will be commenced in a few days, and work on both will then be vigorously carried on. The terminus on the Jersey shore will be about half a mile from the water, and that on the New York side has not yet been fully fixed upon.

It is as yet uncertain what means will be adopted for taking trains of cars through when the work is done, although it has been suggested that the pneumatic plan might be adopted, and compressed air used as a motor. The different railroad lines terminating in Jersey City will, it is supposed, make common use of the tunnel, on some such plan as the several roads now use the Grand Central depot, each paying pro rata, according to a scheme to be agreed upon with the tunnel company. It is thought that 400 trains a day can be passed through, using the tunnel throughout the twenty-four hours, and doing most of the freight business at night.

It seems to us that no one who has at heart the true interests of the country can hesitate to give encouragement to the progress of this work. It establishes a new line of unbroken communication between the East and West, greatly increases the



HUDSON RIVER TUNNEL—LAYING THE IRON PLATES.

business facilities of New York city, promotes rapid transit, and adds to the wealth and prosperity both of city and State. The legislature of New York should assist the work by promptly granting the most liberal facilities for establishing depots and necessary works on the New York side of the river. Congress has just passed the bill to facilitate the organization of a great International Exhibition, to be held in New York city in 1883. If the State legislature will now act promptly in granting the modest requirements of the tunnel company this great work of tunneling the Hudson will be completed before the exhibition opens and in time to bring millions of passengers from the North, South, and West directly into the limits of the city. The great railway tunnel under the Thames river, at London, 1,600 feet long, is justly regarded as one of the most remarkable engineering works ever undertaken. But this Hudson river tunnel, which will be over 5,000 feet long, puts the Thames work far into the shade. Mr. D. C. Haskin, the originator and manager of the Hudson tunnel, is entitled to every aid which the citizens of New York can give him in the prosecution of this great undertaking. He deserves the highest honors for his sagacity and perseverance in pressing forward the enterprise, in the face of the most inveterate prejudices, carpings, adverse opinions, and criticisms of engineers, and even active opposition of most powerful opponents. It is plain that we have in Mr. Haskin the right man at the head of the work.

Our various illustrations require but little explanation. On the front page we give views of the interior of the tunnel, showing the manner in which the iron shell is put in, the earth heading being cut in the form of stairs to facilitate the workmen in putting in and bolting the iron shell, no staying being required. The brick lining, and the mode of mixing the excavated silt with water and its discharge from the tunnel through the air pipe, are also shown. In addition to the engravings here given we publish in our SUPPLEMENT this week a number of additional engravings, showing the sectional view of the river, with tunnel built as proposed, with depths of water and distances; also a side sectional elevation of the tunnel works as far as they have advanced, showing the location of the air machinery, and all parts and appliances of the work; also plans and diagrams of the approaches; and a detailed description of the whole. We shall watch the progress of this great work with pleasure, and keep our readers supplied with all facts of interest thereto relating.

The Franco-Lorillard Expedition.

M. Charnay, in charge of the Franco-Lorillard Explorations in Mexico and Yucatan, sailed from this port for Mexico, April 21. On his arrival at the Mexican capital, M. Charnay will engage excavators and proceed at once to the places marked on the plateau of Anahuac during a previous visit, as likely to yield evidences of the extinct civilization he proposes to study. M. Charnay has already sent from France to Vera Cruz over four tons of implements and machines for use in his work of exploration, including two tons of elastic hemp paper, for moulding purposes, dredges for the sacred lakes of Yucatan, where he intends to search for the jewels cast into the water in idolatrous worship as offerings to the gods, ladders in sections with iron clamps, and photograph materials.

In stating his plans to a *Herald* reporter M. Charnay said: "I do not suppose that I shall reach Central Mexico for five or six months. From my own observations on the spot and from the statements of other writers, I take it that traces have already been discovered in the province of Yucatan of about forty ancient cities. Further, there are unmistakable indications that this district and these cities were more densely populated than is any known portion of the globe at the present moment. It is a puzzle as to how these people subsisted, as the district is rocky and barren in the extreme save for a prodigious growth of underwood or scrub, which presents a formidable obstacle to the rapid prosecution of excavations. During my recent explorations on behalf of the French Government in Java, I was much struck with the general resemblance existing between the traces of the ancient inhabitants of that country and those I found in Mexico. But a much higher degree of civilization is indicated as having existed in Java. We have at present in view a two years' sojourn in Mexico and Central America, but if necessary our stay may be protracted even another year."

Demand for Immigrant Labor.

The Secretary of the Board of Emigration reports that the labor bureau of Castle Garden is besieged with applicants for newly arrived help. The most of the applications for domestics are for German and Swedish girls. There is also a large number of applications from silk mills in Paterson, N. J., and in Connecticut, for factory girls and families. One firm wants thirty families with children old enough to work, and promises them good homes, steady work, and fair wages. The Russell Manufacturing Company, of Middletown, Conn., recently sent for thirteen families. Neither of these orders could be filled at once. There are many inquiries from firms in this city for girls to work at china decorating.

The demand for men is much greater than for women, principally for experienced iron workers, miners, brickmakers, and weavers, and the supply is inadequate. In one day 152 men and boys were sent to different parts of the country, and the day before 178 more were sent from the Castle Garden labor bureau. Of these some were engaged to work in coal and iron mines in this State and Pennsylvania; several Germans were sent to Frary's cutlery works in East Bridgeport, Conn.; 40 Hungarians were sent to brickyards in New Jersey; 20 Hungarians were forwarded to the brickyard at Northport, L. I., and a few farm laborers were sent to Connecticut. Applications are on file with Mr. Jackson from fifty different places for silk weavers, wrappers, and winders, cotton and woolen weavers, spinners, and cardroom hands. One application was received for 300 carpenters to work on the new hotel at Rockaway Beach, the wages offered being $2.25 a day, with an average of two days' overtime each week in good weather. Applications were received from the Columbia Stone Company, North Amherst, Ohio, for 20 or 30 Germans to work in the stone quarries; 100 stonecutters in other places; 10 moulders; machinists, pattern-makers, rollers, heaters, puddlers, and skilled hands of all kinds employed in iron manufactures. Not more than 300 silk weavers have arrived here since January 1, and most of them were engaged before they left home.

The total number of immigrants landed at Castle Garden from January 1 to April 20 was 56,404, a number surpassing any previous record in the history of emigration to this country.

Of the new arrivals there came from Germany 9,884; Ireland, 7,143; England, 4,537; Sweden, 3,003; Norway, 307; Denmark, 481; Netherlands, 565; Belgium, 304; Switzerland, 1,479; France, 508; Italy, 1,770; Greece, 138; Russia, 718; Luxemburg, 161; Bohemia, 300; various other countries, 193.

CRIME IN BENGAL.

The area of Bengal under British control is about that of Great Britain and Ireland, with about the same number of inhabitants. The population is made up principally of native Hindoos and the Mohammedan descendants of the ancient Mogul invaders.

In a lecture on what the English have done for the Indian people, delivered to the members of the Philosophical Institution, Edinburgh, Dr. W. W. Hunter, Director General of Statistics to the Government of India, said, according to the London *Times* report: "There was now only about one-third of the crime in Bengal that there was in England. While for each million persons in England and Wales there were 870 criminals always in jail, in Bengal, where the police was very completely organized, there were not 300 convicts in jail for each million; and while in England and Wales there were 340 women in jail for each million of the female population, in Bengal there were less than 20 women in jail for each million of the female population."

A well paid and highly disciplined police, the doctor said, now deals efficiently with the small amount of crime in Bengal; a happy state of things attributable to British rule, if the British view of the case is to be accepted.

It would be interesting to know how many of the Bengal criminals are of European parentage; and why it is that British rule at home shows results so poor in comparison with India. Of course it would not do to suspect that those benighted pagans and Mohammedans are naturally inclined to lead more wholesome and honest lives than the masses of Great Britain. Christian civilization would stand aghast at such a thought. Perhaps the missionaries, who tell us so much about the land where every prospect pleases and only man is vile, may be able to make clear the puzzle.

The Milling Roller Suits.

On February 2, Judge Treat, in the United States Circuit Court, rendered a decision in the case of R. L. Downton *vs.* The Yaeger Milling Company, of St. Louis, for the alleged infringement of Mr. Downton's process patent No. 162,157. The case came up for hearing on January 10, and on the date given above the court dismissed the bill and gave judgment for the defendant. The points at issue in this case are too well known to need extended expatiation in this connection. Mr. Downton's patent claimed the process of removing the germ from middlings by passing the latter through rolls. An erroneous impression prevails that the claims put forward by Mr. Downton were broader than this, but such is not the case. The patent did not cover the use of rolls on wheat, bran, or purified middlings, but simply the extraction of the germ by means of rolls. The Yaeger Milling Company purchased a number of Wegmann's Porcelain Rolls of E. P. Allis & Co., of Milwaukee, and it was for the use of these that Mr. Downton brought suit, which has ended in the courts declaring that Mr. Downton's patent lacked novelty. Mr. Downton has appealed the case to the Supreme Court of the United States, and has given notice that he will bring suits in other circuits.

The *American Miller* says that this decision frees the Millers' National Association from paying the royalty agreed upon in the compromise made last spring by that body in its annual convention. By the terms of that agreement the members of the association were to pay the Downton Purifier Manufacturing Company a royalty for the rolls then used in members' mills of $25 per set for the first three sets of rolls, $15 per set for the second three, $10 per set for the next four, and all over that number (ten sets), $5 per set, the payment to be made when the validity of the patent should be sustained by a decision of a Circuit Court of the United States. For the time being, therefore, the roller litigation may be regarded as over, and millers using rolls can breathe easy for awhile.

NEW INVENTIONS.

A means for determining the action and effect of steam in the retorts when manufacturing water gas has been patented by Mr. Henry C. Bowen, of New York city. In the manufacture of water gas the method heretofore in general use is to charge a retort or generator with coal, then bring it to a state of incandescence by driving air through it, then to shut off the air and force steam through the incandescent mass of coal. At this high temperature the incandescent carbon decomposes the steam, forming carbonic acid and hydrogen, and the carbonic acid, as it passes farther through the mass, is itself decomposed or robbed of one equivalent of oxygen by the carbon to form carbonic oxide. The commingled carbonic oxide and hydrogen then constitute the base of the water gas, and pass out of the generator, to be subsequently carbureted by passage through a hydrocarbon, and then fixed to form a stable gas by being heated in a separate set of retorts. The object of this invention is to provide means for enabling the operator to detect at any time the passage of undecomposed steam along with the carbonic oxide and hydrogen.

A device for operating elevators, so constructed as to raise the cages of the elevators by the movement of a train of cars, and which is especially designed for operating passenger elevators at stations upon elevated and underground railways, has been patented by Mr. Nicholas Nolan, of New York City.

A simple and efficient apparatus for cooling liquids and freezing ice cream by means of chemicals, has been patented by Mr. William F. Clapp, of Allemance, N. C. The invention consists of an oscillating or rotary vessel provided with compartments for the cooling mixture and the liquids to be cooled, and a central chamber for the reception of the ice or other refrigerant and the vessel containing the cream.

Mr. John De Frain, of Philadelphia, Pa., has patented an improved vegetable cutter, which is so constructed that it may be adjusted to cut the vegetables into slices or strips of any desired thickness.

An improved sash supporter, which is simple in construction and operation, and which holds the sash in any desired position, has been patented by Mr. William W. Sweetland, of Edwardsburg, Mich. The invention consists of an articulated spring latch, through which a rod fastened to the upper part of the window frame passes, and against which the latch is pressed to hold the sash in position. The latch is operated by means of a lever worked by a cord.

The First Rolling Mill in America.

To the Editor of the Scientific American:

I wish to correct a statement in your issue (No. 7) regarding the first rolling mill in America.

Your correspondent is mistaken in stating that his father built the first rolling mill in this country. My great-grandfather, Isaac Pennock, established one in 1798. I have the ledger bearing that date now in my possession.

The mill was called the "Federal Slitting Mill," and was located in East Fallowfield Township, Chester county, on the Buck run. It was used for rolling sheet iron and strips, principally the latter, which were slit up into rods for nails, etc. All nails then were forged out of rods by hand on the anvil. There were no boiler plates made or needed in those days.

My grandfather, Dr. Charles Lukens, was the first maker of boiler plates in Pennsylvania, and it is to be presumed in America. He was for a time at the Federal Slitting Mill, but in 1816 moved to Coatesville, and operated another mill called "Brandywine Iron Works." There boiler iron was first rolled.

At the death of Dr. Lukens, in 1825, the business was carried on by his wife, Rebecca W. Lukens, who greatly increased it and conducted it successfully for a number of years. As a tribute to her memory the name of the works was, after her death, changed to "Lukens Rolling Mill."

This was the first of the several mills now in this town, and has been operated continuously in the family from 1816 to the present day. It is now used merely as a feeder to a large steam mill erected alongside.

There were no railroads in this country then, and all iron and fuel had to be teamed, most of it to and from Wilmington and Philadelphia, the former 26, the latter 39 miles distant; some, however, was teamed to Pittsburg (315 miles) and beyond.

The old Federal Slitting Mill has long since been abandoned for manufacturing iron. A paper mill is now erected on its site.

A. F. HUSTON.

Lukens Rolling Mill, 2d mo. 14th, 1880.

Wild Dogs in the West.

For several years a pack of wild dogs have been known in the Yellowstone Valley. They are described as resembling a cross between a wolf and a spaniel. A more savage pack of wolf dogs are now reported in the wilds of Northwestern Nebraska. It is said that about two years ago two bull-dogs joined a band of wolves near the head of the Birdwood, and have remained with them ever since. Within the past year a species of dog-wolf, supposed to be the offspring of the escaped bull-dogs, have been committing depredations in that section. They are said to possess the cunning of the wolf combined with the ferociousness and pluck of the bull-dog, and are consequently much more to be dreaded than the common prairie wolf, and are far more bold and savage. The Deadwood *Times* says that they are becoming numerous and quite troublesome.

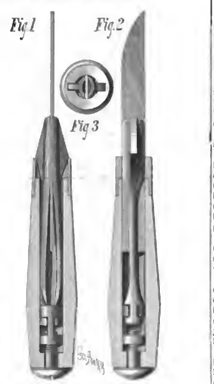
The Opium Traffic of Asia.

In a review of the British opium trade in India and China, Professor Christlieb, of Bonn, gives the following statistics showing the magnitude of the trade and its effects upon Indian agriculture:

Since the conclusion of the treaty of Tientsin, in 1860, the quantity of opium annually imported into China from the East Indies has increased to 80,000 chests. In 1875 as many as 85,454 chests, worth £10,000,000, were brought into the Chinese market, 8,943 of which were sent to Malacca, while the consumption of the drug for medicinal purposes in Great Britain in the same year reached only 165 chests. The progressive growth of the trade during the past eighty years is thus shown: In the year 1800, about 5,000 chests; in 1825, 12,000; in 1850, 50,000; and in 1875, 90,000. Among the most striking effects caused by the extension of poppy plantations in India are the diminution of the quantity of land available for other crops and the consequent curtailment of food products. In Benares and Behar, immense tracts of the finest and most fertile land in Northern and Central India have been gradually covered with poppy plantations. Quite recently 100,000 acres of the richest plains in Central India, and 55,000 acres in the Valley of the Ganges, which formerly used to produce corn, sugar, and indigo, have, to the impoverishment of the soil, been devoted to opium culture. The acreage devoted to that purpose to-day is estimated at 1,033,000 acres.

IMPROVED KNIFE HANDLE.

The annexed engraving shows an improved extension cutting blade handle, recently patented by Mr. Wilbur Webster, of East Jaffrey, N. H., Figs. 1 and 2 being longitudinal sections taken at right angles to each other, and Fig. 3 is an end view showing the shape of the jaws.



WEBSTER'S KNIFE HANDLE.

The invention consists of a handle containing two semi-tubular clamps, having their inner ends fitted to recesses in a movable block held by a screw in the end of the handle. The connection of clamps with the movable block is very simple and effective. The free ends of the clamps are provided with tapering projections that bear against the ferrule at the end of the handle as the clamps are drawn in by the action of the screw. The clamps are prevented from turning by slots cut in diametrically opposite sides of the ferrule for receiving the projections on the clamps.

This handle is adapted to a variety of tools, but it is more especially designed for flat cutting tools.

Further information may be obtained by addressing the inventor as above.

Statistics of Cotton.

According to the latest reports the great cotton spinning industry embraces throughout the world 71,250,000 spindles, of which 39,500,000 are in Great Britain. The United States have 10,050,000 spindles; France has 5,000,000; Germany, 4,800,000; Russia, 2,860,000; Switzerland, 1,870,000; Austria, 1,800,000; Spain, 1,775,000; Italy, 900,000; Belgium, 800,000; India, 1,275,000; Sweden and Norway, 310,000; Holland, 230,000; Greece, 36,000; and other countries (including Denmark and Portugal), 44,000 spindles. Britain has to every 1,000 of its inhabitants, 1,180 spindles; Switzerland, 675; United States, 218; France 135; Germany, 108; Spain, 108; Holland, 57; Sweden and Norway, 48; Austria, 42; Russia, 30; Italy, 29.

SIMPLE TELEPHONE TRANSMITTER.

BY GEO. A. HOPKINS.

There are telephones and telephones, but in the host of instruments so named the successful ones may be counted

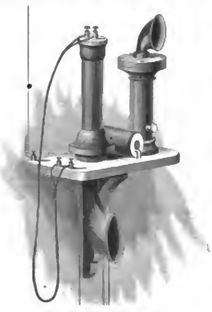


Fig 1.—SIMPLE TELEPHONE.

upon the fingers of one hand. Of telephonic receivers it may as well be said there are but two, for there are only two principles involved in their construction. Of transmitters there are but two that have gained any notoriety and retained their foothold as useful instruments.

Having a chronic liking for telephonic research I have made it a point to try the various telephones as they have been made known to the public, and have found that with but few exceptions they are defective and useless as practical instruments, and interesting only at exceptional times when the conditions for experiment are favorable, and the adjustments delicately made.

In the course of these experiments the transmitter shown in the annexed engravings was devised, and it was subsequently developed into a usable instrument possessing all of the qualities requisite in a telephone. In the first place, it is so simple as to be capable of construction by the merest tyro, and never needs adjustment. It requires neither call bell, keys, nor switches when used in an ordinarily quiet place, with a closed local circuit.

Fig 1 is a perspective view, showing the relative arrangement of the transmitter and receiver; Fig. 2 represents the arrangement of the local circuit and line; and Fig. 3 is a vertical section of the transmitter.

The transmitter is fixed to the bracket and stands vertically, with its sound-collecting mouthpiece pointed in the direction whence the sound proceeds. The receiver, which is an ordinary Bell instrument, stands when not in use over a curved pendent resonator, the smaller end of which projects through the shelf of the bracket and just enters the hole in the center of the receiver mouthpiece.

Between the transmitter and the receiver there is a small induction coil, whose primary wire is connected with the local battery and the transmitter. One terminal of the secondary wire of the coil is connected with the receiving instrument and line, the other terminal is grounded. These connections will be understood by reference to Fig. 2. *a* and

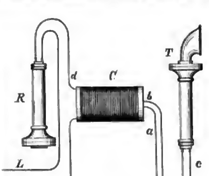


Fig. 2.—ARRANGEMENT OF TELEPHONE CIRCUIT.

b are the terminals of the primary wire of the induction coil, C. The terminal, *a*, connects with the battery, B; the terminal, *b*, runs to the transmitter, T, connected with the battery by the wire, *c*. One terminal of the secondary wire of the coil, C, is grounded; the other terminal, *d*, connects with one binding post of the receiver, R, the other binding post being in communication with the line wire, L. This arrangement is adapted to a closed circuit, one or two cells of gravity battery being connected with the transmitter. If an open circuit battery is used a switch is placed in one of the wires, *a*, *b*, *c*, so that the local circuit may be left open when the talking is done.

The construction of the transmitter will be seen in the vertical section, Fig. 3. The diaphragm, A, has attached to its center a small brass cup, B, containing a button of ordinary battery carbon three sixteenths of an inch in diameter and about the same thickness. This carbon projects beyond the brass cup, and is surrounded by a short paper tube, which projects beyond the face of the carbon one eighth inch. A piece of copper foil placed between the brass cup, B, and the diaphragm extends to the edge of the diaphragm, where it is pressed by a spring in the cell, C, which is in metallic contact with a wire extending downward through the lower end of the instrument.

The standard supporting the diaphragm cell is hollow, about five eighths inch internal diameter, and the height of the diaphragm above the bracket is four inches.

In the standard there is a bottle, D, of special form, supported by a ring, E, having a threaded stud extending through a slot in the standard, and provided with a milled thumb nut, by which it may be clamped at any desired height. The bottle, D, has a long narrow neck, about three sixteenths inch internal diameter, and a platinum wire blown in the lower end connects with the local circuit wire, which is coiled to admit of moving the bottle up or down. This wire extends through the base of the instrument, and is connected as shown in Fig 2. The bottle, D, is partly filled with mercury, in which floats a pencil, F, of carbon of the kind used for electric lighting by incandescence. This pencil is one eighth inch in diameter, two and one eighth inches long, and is made slightly convex and very smooth at the

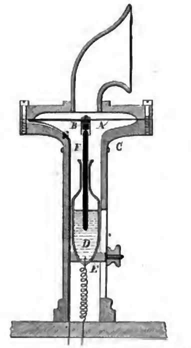


Fig. 3.—TELEPHONE TRANSMITTER.

ends. The mercury buoys the carbon up so that it is always kept in light and uniform contact with the carbon button, while it also forms part of the conductor in the local circuit. The carbon attached to the diaphragm is perfectly plane on its contact surface, and as smooth as it can be made by means of a fine file.

The diaphragm, which is of mica, has one and three-fourths inches free to vibrate. It is rather stiff, and is clamped firmly in its cell. The surfaces between which the diaphragm is clamped are perfectly true, and made of material not liable to warp. Wood well soaked in paraffine answers a good purpose, but vulcanite is far better.

The induction coil used with the instrument is of the ordinary form, two inches long, one inch in diameter, with a three-eighths inch core of No. 18 soft iron wires. The primary coil consists of three layers of No. 18 silk covered copper wire, and the secondary of No. 36 in sufficient quantity to fill the spool. One cell of Leclanche or Fuller battery will work the transmitter, but two will augment the volume of sound.

As to the efficiency of this instrument it will bear comparison with other transmitters, and in one or two points it seems to have an advantage. It will transmit speech clearly whether the speaker is within ten inches or as many feet of the instrument. Although a call bell may be used in connection with it, generally none will be required, as by saying o-o-o-o loudly in the mouthpiece a trumpet-like sound is heard in the receiver at the other end of the line, which, although not very loud, is sufficient to attract attention in a measurably quiet room.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR MAY, 1880.

Mercury.

On May 1 Mercury rises at 4h. 10m. A.M. On the 31st Mercury rises at 4h. 23m. A.M.

Mercury, Venus, and Saturn rise nearly at the same time on May 1, in the hour preceding sunrise, Venus being farthest north.

Mercury and Neptune will be in close proximity on the 18th, but they rise so nearly with the sun that Mercury is not likely to be seen.

Venus.

On May 1 Venus rises at 4h. 18m. A.M. On May 31 Venus rises at 3h. 57m. A.M.

Although Venus rises so nearly with the sun during May its brightness will make it conspicuous.

Saturn and Venus rise nearly at the same time on May 1. Saturn is south of Venus.

Mars.

Mars is the only planet to be seen in the evening sky of May.

On May 1 Mars rises at 8h. 35m. A.M., and sets at 11h. 47m. P.M.

On May 31 Mars rises at 8h. 6m. A.M., and sets at 10h. 52m. P.M.

On May 1 Mars is west of the star Delta Geminorum, at a declination 2° farther north; it passes this star on May 9 at a distance of 1¼° north. On the 15th Mars has the right ascension of Castor, but is nearly 9° south of that star. The crescent moon may be seen to move toward Mars on the evening of the 13th.

Jupiter.

Jupiter will be brilliant in the early mornings of May.

On the 1st Jupiter rises at 3h. 41m. A.M.; on the 31st at 1h. 57m. A.M.

Jupiter may be seen south of the waning moon on the morning of May 5.

Saturn.

Saturn, Venus, and Mercury rise nearly at the same time on May 1, Saturn being about 1° south of Venus.

On May 31 Saturn rises at 2h. 31m. A.M., following Jupiter after about half an hour, and making its diurnal path 3½° north of Jupiter. The waning moon and Saturn have nearly the same right ascension on the morning of the 7th. Saturn is nearly 8° south of the moon.

Uranus.

Uranus rises on May 1 at 1h. 9m. P.M., and sets at 2h. 25m. A.M. of the next day.

On the 31st Uranus rises at 11h. 12m. A.M., and sets 27m. after midnight.

Uranus is still very near the star Rho Leonis. On May 31 it is half a degree east and half a degree north of this star, when on the meridian.

Sun Spots.

A large group of spots, including three of more than ordinary size and some ten or twelve small ones surrounded by faculæ, was seen on the sun's disk on April 12. These spots passed out of sight by the motion of the sun on its axis between the 14th and 15th of April.

If this group reappears, as is probable, it will be well advanced upon the sun's disk early in May. A telescope of low power (with a colored glass) will enable an ordinary observer to watch the changes of these spots, as caused by the sun's turning, and also those variations which belong to the violent action on the sun's surface.

A Dangerous Amusement.

As out-door sports begin the girls are sure, this spring, to take their usual turn at rope jumping. Scarcely a season passes without several reports of girls dropping dead after some long continued effort, as in trying to skip the rope a thousand times; and even when not so carried to excess the practice is decidedly hazardous. Dr. Peck, of the Surgical Institute at Indianapolis, pronounces it a prime cause of cripples among girls. Speaking of a recent operation in which the bones of both legs of a little girl had been removed owing to necrosis caused by rope jumping, Dr. Peck says that similar cases are of frequent occurrence, though the mischief more commonly shows itself in necrosis of the spine. Not a month passes but cases are brought to the institute to be treated for injuries brought on by the continuous concussions upon the bones in this amusement. He advises parents and teachers to prohibit the "pernicious pastime" at all times and under all circumstances.

The New York International Exhibition of 1883.

The Senate bill (No. 1160) to provide for an International Exhibition in this city in 1883 was passed by the House of Representatives April 19. It had already been passed by the Senate, but having been slightly amended by the House it was returned to the Senate for the concurrence of that body. The chief amendment consisted in the addition of the names of the members of what is known as the Hilton committee to the original list of incorporators. The changes were concurred in by the Senate April 20. It is to be hoped that the differences between the rival committees will be promptly and amicably settled, and that nothing will occur to hinder the prosecution of the enterprise.

THE GREAT SOUTHERN COMET.

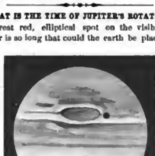
The event which is creating a considerable sensation in the southern hemisphere is the nightly appearance in the southwestern heavens, shortly after sunset, of a large and luminous body, supposed by those conversant with the aspects of such celestial visitants to be a comet of no ordinary kind. It is remarkable that astronomers throughout the British colonies and in England have not given the least intimation or prediction as to its coming.

The appearance of the present comet is what astronomers designate "a beam." Its continuance is uncertain, though it may remain visible for some time, especially as it has not yet attained its perihelion and the nucleus has not been seen, though, doubtless, it will be at the Cape, France, England, and other countries. In brilliancy and grandeur it is vastly inferior to the comet which appeared in the early days of the colony.

Our illustration represents the comet as it appears nightly; that it is wonderful and awe-inspiring, we admit, but the absence of superstition from our minds, and a belief in the opinions of scientific men as to the cause of such phenomena, has banished all dread as to the baneful results which are expected to follow its appearing. The most notable comets of modern times are those of 1843, 1847, 1853, 1858, and 1861. That of 1843 is still regarded as the most marvelous of the present age, having been observed in the day-time before being visible at night—passing very near the sun—exhibiting an enormous length of tail of a fiery character, and arousing interest in the public mind as deep as it was unprecedented. Whether the comet now visible to us has anything to do with the heat of the atmosphere we cannot say, but it is a fact that for days prior to its coming the temperature was higher than usual.—*Frearson's Weekly, Adelaide, Australia.*

WHAT IS THE TIME OF JUPITER'S ROTATION?

The great red, elliptical spot on the visible surface of Jupiter is so long that could the earth be placed at one



Jupiter seen through a 9 in. telescope.—Power 350.—7h. 40m., Oct. 20, 1879.

end of it and rolled it would make nearly a complete revolution before arriving at the opposite end; and so wide at the widest part that the earth would overreach it on either side by but little more than half the diameter of our moon, and stands in such contrast to the surrounding disk as to be visible with large telescopes when the planet is but three hours from the sun in right ascension, and the sun on the meridian.

The authorities, Sir William Herschel, Beer, Mädler, and others, give for the time of Jupiter's rotation 9h. 55m. 20″. The red spot was estimated central on the disk, October 3, 8h. 55′, 1879; on January 10, 5h. 40m., 1880, it was again estimated central, having in 98d. 20h. 45m. made 239 apparent revolutions about the axis of Jupiter—approximate real time of rotation, 9h. 55m. 37″+.

It has been suggested that this spot affords an excellent opportunity for determining the time of Jupiter's rotation; and the attention of amateurs has been called to this work by a note from abroad.

It is generally believed by scientists that no considerable portion of a planet's atmosphere is likely to move much faster in the direction of the planet's rotation than the planet beneath travels; that any considerable motion must be in a direction opposite to the planet's rotation.

If this red spot represents the time of Jupiter's diurnal rotation that planet presents to us the remarkable phenomenon of the whole equatorial atmosphere moving in the direction of the planet's rotation 6,500 miles farther in 24 hours than the surface of Jupiter beneath it travels in the same time.

Most of the cloud forms in the equatorial belt are far from permanent, either in location or outline; some of them change so much in a few days as to be unrecognizable; but a well defined light spot was observed about central on the disk of Jupiter, September 27, 1879, at 8h. 5m., which, after making nearly 356 revolutions about the planet's axis, was last seen, unchanged to any great extent, just coming on the disk, February 20, 1880, at 4h. 55m.—approximate real mean rate, 9h. 50m. +.

On September 28, 1879, it was noticed that the red spot and the markings on the equatorial belt were separating at a rate which would bring them again together in about 43 days. Since then it has been observed that when the red spot has made 105 to 109 revolutions about Jupiter's axis the equatorial belt will have made one more.

When Jupiter rises on the morning of May 22, 1880, the red spot will probably be on the disk, and that portion of the equatorial belt above mentioned north of the spot. At 4h. 10m., Washington mean time, it is estimated that the red spot will have passed the center of the disk, and the planet will be high enough for observation in the eastern part of the United States.

Accepting 9h. 50m. as the time of Jupiter's rotation, the spot is traveling rapidly westward. Suppose it to have an independent rotary movement, in the direction taken by the hands of a watch, which on the circumference is not less than 250 miles an hour, sometimes much more, and it will account for about all the observable phenomena in the region of the spot. H. G. FITZ.

Peconic, N. Y., April 7, 1880.

The Geodetic Union of Europe and Africa.

The important work of connecting the systems of triangulation covering Western Europe and Northern Africa was consummated in the latter part of October last. Preparations for it had been going on for several years under the direction of General Ibañez and M. Perrier, acting respectively for the governments of Spain and France.

Four mountain heights were selected for signaling operations, namely, Mulhacen and Tetica, in Spain (the former being the highest in that country), and Filhaoussen and M'Sabiha, between Oran and the frontier of Morocco. It was decided not to trust alone to solar signals, but also to employ the electric light at night, and the event fully justified this resolve, for the solar signals totally failed, being seen neither in Spain nor Algeria. The difficulties of the enterprise, then, will be obvious on consideration, for to produce the electric light with sufficient intensity it was necessary to have recourse to electro-magnetic apparatus driven by steam engines, and the problem was that of hauling up Gramme machines, engines of six horse power, and various instruments, to summits of 1,000 to 3,550 meters height, making roads on these desert mountains, organizing supplies of water and fuel, and finally providing accommodation and sustenance at each station for twenty to one hundred men and fifteen or twenty beasts. There was a military guard attached to each station (in Algeria especially this was necessary), and the soldiers worked in roadmaking, etc. The time open for operations was short between the intense heat and the early snows. On August 20 all were at their posts—Colonel Barraquer on Mulhacen, Major Lopez on Tetica, Captain Bassot on Filhaoussen, and M. Perrier on M'Sabiha. But in vain were solar signals sent by day and electric by night; the vapors from the Mediterranean proved impervious to the beams. At length, however, on September 9, after twenty days' feverish expectation, M. Perrier perceived the electric light of Tetica, visible sometimes to the naked eye, like a round reddish disk, as bright as Alpha in Arcturus, which appeared near the horizon. On the 10th he perceived the electric light of Mulhacen. The Spaniards also perceived the French signals, and a period of definite observation was entered upon, extending from September 9 to October 18. The geodetic junction of the two continents was at length realized. The numerical results arrived at with regard to those four immense triangles of some seventy leagues length of side are given in a communication by M. Perrier to the French Academy, and are shown to have satisfactory accuracy.

By this work the geodetic operations in the British

Islands, France, Spain, and Algeria, were united into one grand system of triangles, reaching from the Sahara (34° N. L.) to the northernmost of the Shetland Islands (61° N. L.), giving a meridian arc of 27°, the greatest hitherto measured on the earth.

NEW LIFE PRESERVER.

The engraving shows a novel life preserver recently patented by Mr. Rufus E. Rose, of Gretna, La., which may be combined with different garments worn upon the person, or it may be made as a separate article and worn independently of the clothing.

The invention consists in several air chambers, A, provided with inwardly opening valves, C, which may be operated independently, and an air supply tube, B, communicating with the several chambers through separate valves.

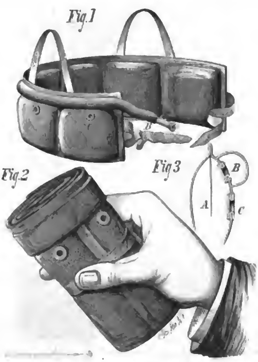
Fig. 1 shows the life preserver inflated and ready for use; Fig. 2 gives a good idea of the size of the life preserver when rolled up and out of use, and Fig. 3 is a transverse section showing the arrangement of the valves.

The chambers are inflated by blowing through the supply tube, which is provided with a suitable mouthpiece. The great advantage of this form of life preserver lies in the separate chambers. One or more of the chambers may be punctured without destroying the efficiency of the device, as the remaining chambers will retain their charge of air.

This life preserver when uninflated is so light and compact that it may with convenience be combined with some of the garments worn by the user, when it will always be in position for use. The form shown in the engraving is fitly called a "pocket life preserver," as it may be rolled into so small a package as to be conveniently carried in the pocket, occupying no more space and weighing less than an ordinary diary or memorandum, and when it is inflated it is sufficiently buoyant to sustain two persons.

The inventor informs us that this invention was suggested by an article in the SCIENTIFIC AMERICAN some time since which pointed out the necessity for such an invention.

Further information in regard to this life preserver may be obtained by addressing the inventor as above.



ROSE'S LIFE PRESERVER.

Endurance of Boilers.

Some idea of the difficulties encountered, in the use of the impure water in locomotives in some of the Western States, may be formed from the following extract from a letter from a master mechanic in that region to the *Railroad Gazette:*

"At this end of the road, where we have so much alkali water to contend with, we are obliged to change the flues every six months to get the scale out of the boiler and from around the fire box. Along with this we wash our engines thoroughly the best we can for every four hundred miles run, with a force pump and seventy pounds pressure, taking out the blind flues, mud drum head, and all the wash-out plugs in the sides and in the legs of the boilers, and even with this constant work our flues will not last longer than six months without giving us a great deal of trouble from leaking on account of the mud and scale."

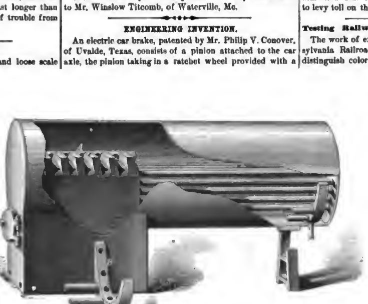
NEW BOILER CLEANER.

The operation of removing the sediment and loose scale from beneath the tubes of locomotive boilers, when conducted in the usual way, is laborious, expensive, and damaging to the boiler, as no means of access to this part of the boiler is provided, and the steam pipes and exhaust nozzles have to be removed and the ends of the tubes cut off before the bottom of the boiler can be reached. This being the case the examination of the boiler is often deferred, so that a great mass of scale and sediment accumulates and hardens so that it can be removed only by means of the hammer and chisel.

The invention shown in the annexed engraving is intended to overcome these difficulties, and to furnish a convenient and effectual means of loosening and moving the scale so that it may be easily removed. The invention is applicable to all kinds of tube boilers, but is more especially useful on boilers of the locomotive type.

It consists of two tubes, A B, provided with jet openings or tubes, and having external connections leading to a boiler for supplying steam or to a supply of water under pressure. The inventor prefers to make these jet tubes of brass, and to place them in the positions indicated in the engraving. The jets of the tube, A, are directed across the crown sheet, and the jets of the curved tube, B, point toward the water leg of the boiler, and in the upper surface of the curved tube, B, there are jets pointing upward. When jets of steam are admitted to the boiler through the tubes, A B, the scale is loosened and moved to the water leg, from which it may be easily removed through the hand holes. The inventor states that steam removes the scale from the tubes with surprising rapidity, so that they are left in good condition for generating steam. When two or more stationary boilers are used in one locality the steam from one may be used to clean the other. Where there is only one boiler a well jacketed steam drum may be used to store up a sufficient quantity of steam to clean the boiler. In the case of large round houses the inventor proposes to apply a large stationary boiler to this purpose, placing it centrally and providing it with suitable connections for conveying the steam to the cleaner in any of the empty locomotives. By an arrangement of this kind two locomotives could be cleaned and washed at once. The inventor does not confine himself to any special form or arrangement of this cleaner, as it can be adapted to any style of boiler. The application of this device to a boiler economizes fuel, improves its steaming qualities, prevents pitting, and saves a great deal in the way of repairs.

This invention is protected by United States patents issued to Mr. Winslow Titcomb, of Waterville, Me.



TITCOMB'S BOILER CLEANER.

ENGINEERING INVENTION.

An electric car brake, patented by Mr. Philip V. Conover, of Uvalde, Texas, consists of a pinion attached to the car axle, the pinion taking in a ratchet wheel provided with a projecting pin that enters into the slots of a wheel provided with a sleeve, upon which the brake chain is wound, which sleeve can be moved on the axle by means of a lever that is actuated by a rod passing into a helix connected with a battery on the locomotive. A pawl tooth that is held in place by a slide prevents the unwinding of the brake sleeve until the slide is removed by a lever actuated by a rod passing into a helix likewise connected with the battery on the locomotive.

Practical and Useful Inventors.

In almost every community is to be found at least one man who professes to have given the first hint toward the perfection of some invention that has brought its introducer fame and fortune, neither of which the suggester shares. It may be that in some instances this claim is correct, but usually the sympathies of the people are with the man who does rather than with the visionary who dreams; for there is generally a hard road to travel between the conception of an improvement and its practical adaptation and final success.

There was a time when the inventor was essentially a dreamer; when he environed himself with mystery and was content with the homage of the ignorant. No paternal and wise government extended over him the protection of letters patent; the people did not want his improvement; the world was not ready for him. Chemistry was used to discover the transmutation of metals or the elixir of life, and mechanical knowledge to construct a toy with which to amuse and astonish the ignorant. These men, who thought and wrought in the twilight of science and the dawn of the arts, undoubtedly contributed something to us of the after ages, although in many cases they left their records in ambiguous puzzles. The shadows of the great minds who walked in the slant rays of the rising sun are projected across the plane on which our inventors travel.

But such men as Watt and Arkwright and others diverged from the secluded paths of these impractical thinkers and essayed the broad road of utility. Under their hands the scientific toys of the philosophers became the useful adjuncts to man's needs. This is the true secret of the inventor's success. Utility should be his guide and aim. It is not enough either that he conjectures and speculates: he must demonstrate by actual experiment, on a scale sufficiently large to prove the value of his invention, before he is legally or even properly entitled to the distinction or the reward of the inventor. One may sit and dream day after day of a conjectured improvement, and even feel assured of its value, but it will avail him nothing unless by experiment he builds a foundation better than "the baseless fabric of a vision." While he dreams it may be another is working out a similar dream. It cannot be doubted that many valuable improvements, now in general use and yielding handsome incomes, would have borne another's name and enriched another's pocket if the original inventor had wrought out his discovery to a practical result.

The work of the inventor is not, then, as the Boston *Journal of Commerce* further adds, merely to devise and calculate—to dream and imagine—but to demonstrate and prove by experiment. The true inventor is not a mere visionary, seeing the road and pointing to it, but is a moving, animated man, clearing obstructions from his path and leading the way. If he is independent enough to strike out a new path to a result, he must not be content merely to survey it, but must lay out the road, grade it, and propel himself and his improvement over it, before he can expect to levy toll on those who travel after him.

Testing Railway Employes for Color Blindness.

The work of examining the 5,000 employes of the Pennsylvania Railroad Company to discover their capacity to distinguish colors and forms, was begun in Jersey City, April 1. Acuteness of vision was tested by means of printed cards placed at a distance of about twenty feet; also by means of small openings in a screen illuminated on the further side. Many who successfully passed these ordeals failed signally on the color tests. Three skeins of woolen yarn were used, one being light green, the second rose, and the third red, and were marked respectively 1, 2, 3. Each of these was placed on a table in front of the person examined at a distance of three feet, and, with the vision of either eye obstructed by a spectacle frame, the man under examination was requested to name the color. He was also directed to pick out a similar shade to the one in question from different skeins of woolen yarn, numbered from 1 to 36. One young man correctly designated the test skein as red, but on being told to select a similar shade from the skeins before him he picked three shades of blue, two of yellow, and one of red. He could distinguish no difference, and the same thing happened to half a dozen others who followed him. The skeins on the row were then divided into three sets, with twelve numbers in each, and the men were then examined as to color blindness. Some were able to distinguish all the shades of green, but failed lamentably in picking out the different shades of red.

It is said that the officers of the road were greatly impressed

by the results obtained, and that the directors of the other railways terminating at Jersey City are likely to adopt the same system of examination for their employes.

RAILWAY CREMATION.

It is a pretty universally recognized fact at the present day that burying such animals as have succumbed to a pes-

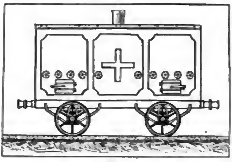


FIG. 1.

tilential disease is not sufficient to destroy the contagious germs which remain in their bodies. This has been shown especially by the researches of Messrs. Pasteur, Chamberland, and Roux. These gentlemen have ascertained that when infected blood is consigned to the earth the bacteria are preserved therein in the germ state, multiply, and, in a short time become transformed into corpuscles which can be detected after remaining in the soil for several months. We ought to welcome, then, a new method of cremation which has been invented by Messrs. Kuborn and Jacques, and which satisfies every sanitary necessity by furnishing an easy means of totally destroying the infected animals. The two accompanying engravings give an exact representation of the apparatus. As shown in Fig. 1, it looks externally like a railway car; but it differs in the fact that rails are dispensed with, the car being drawn on the surface of the ground by horses or mules. Fig. 2 shows the arrangement of the interior of the apparatus. The closed space, A, is designed to receive the cadavers. It is a chamber having walls, R R, impermeable to heat. The bottom is composed of two dead plates, S, both of refractory material, the lower extremities of which terminate in a well, B, so as to form a hydraulic joint. Beneath these dead plates are located two fire places, F F, provided with movable working holes, which, by regulating the introduction of the air, allow of perfect combustion being obtained. The products of combustion reach the chimney through the flues, C, C', and C''

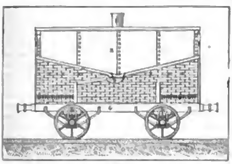


FIG. 2.

Any kind of fuel, no matter what, may be used. The apparatus is simple, and is easily operated at but trifling expense.

Packing Apples with Salicylic Acid.

There are few greater treats during the winter and early spring seasons, says the London *Magazine of Pharmacy*, than the magnificent apples which are imported from America to find their places on the dessert table in England. Considerable numbers, however, arrive here in a bruised condition from the effects of careless packing; a certain amount of fermentation is set up, and unless they are consumed without delay, they are lost to the dessert table. This is more frequently the case when barrels full of the so-called "Newtown pippins," and others, have been exported by private individuals to their friends in England, than when they are packed by the regular tradesmen. There is no reason why this splendid fruit should not be imported here almost as fresh and blooming as when it is gathered from the tree. A common but soft kind of tissue paper should envelop each apple before it is placed in the cask, and this tissue paper should have been soaked in a solution of salicylic acid and dried before it is used. The best preparation of salicylic acid for this purpose is the alcoholic solution, made with the strongest spirit, and then diluted with as much water as it will bear without precipitating the acid, so as to make the solution go as far as possible. Each apple should be enveloped in at least three or four folds of the salicylated paper, and every possible precaution should be taken to prevent bruising when loading into the casks or cases. Well packed apples should not move at all during the voyage, and the shaking of a railway train should have little effect upon them. Nevertheless, a certain amount of contusion is inevitable, and to avoid the ulterior results of this, the salicylated paper is indispensable. As to the cost it would be a mere trifle when we consider the result gained, and the splendid condition of the fruit when it enters the London market. Besides, it is very probable that the salicylic acid paper used for packing the apples in America, might be used over again, or applied here in England to some similar antiseptic purpose, and an allowance made for it accordingly.

SEA BEANS.

BY A. W. ROBERTS.

So much confusion of ideas exists about these so-called sea beans in the minds of most people that I have taken the trouble to obtain all the information obtainable about them.

Fig. 1—Seed of Entada Scandens.

Fig 1 is the seed of a vine, the *Entada scandens*, which grows in the tropical portions of both hemispheres. The vine is chiefly remarkable for the large pods and seeds, the pods often being from six to eight feet long, divided into numerous joints, each one of which contains a bean. In some parts of India these beans are used as weights. In London the seeds are sold under the name of "West Indian filberts." These sea beans are found in large quantities on the coast of Florida, particularly after northeast storms. These beans are worked into various trinkets, such as perfume bottles and snuff boxes. One of our leading jewelers has had some of these sea beans to polish and mount in gold for watchseals and lockets. For polishing the best materials are fine pumice stone powder, putty powder, and rotten stone. After the roughness of the outside of the bean is taken down with the pumice stone powder to a uniform surface, then put on the second polish with putty powder and oil. After which finish with rotten stone and oil on a lap wheel.

FIG. 2.

Any one handy with the graver can embellish these beans with every style of device desired. The beans should be first boiled in water for a half to one hour to soften the outer coating. After the outer coating is softened give it a coating of Winsor & Newton's Chinese white, on which the drawing is made for the engraver to follow. One of the prettiest styles of ornamentation of these beans is that of monograms inlaid with gold bronze. These beans are believed by most persons to be a product of the ocean from the fact of their being found on different parts of our seashore, particularly of the Southern States. I have found them on both the Massachusetts and Long Island shores. They have also been found on the coast of Scotland and as far north as the Loffoden Islands, off the coast of Norway.

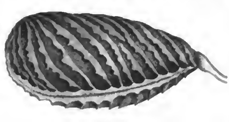


FIG. 3.

Figs. 2 and 3 represent the bean and pod of the "asses-eye," the scientific name of which is *Mucuna urens*. This bean is also a native of the West Indies, and is borne to the Florida coast by ocean currents. These beans have of late years been sent north from Florida in large quantities for the use of jewelers and tortoise shell workers, who convert them into charms for watch chains. They are capable of receiving a very high polish, the same materials being used as directed for polishing the *Entada scandens*. Miniature compasses and portraits are often introduced as a setting in these beans. They grow in short stout pods, covered with brownish bristly hairs, which easily separate, and when handled stick in the fingers, producing an intense itching sensation. The pods of this bean are used to adulterate the pods of the *Mucuna pruriens*, of which the hairs are the officinal portion. These hairs are the cowhage sold by druggists and commonly known as "cow-itch." *Mucuna urens* is a perennial climbing plant, which twines round the trees and rises to a considerable height. The flowers are yellow and large, and resemble the pea blossom in form; usually placed in twos and threes in short peduncles.

The hairs of the *Mucuna urens* and *Mucuna pruriens* are possessed of powerful vermifuge properties, and act mechanically by penetrating the worms.

Legal Responsibility for Machinery Accidents.

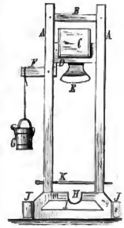
The Supreme Court of the United States has laid down the law as to the responsibility of employers for the lives and limbs of their workmen. They must not expose them to perils which can be guarded against, and if the servant reports defective or unsafe machinery, the master becomes responsible if the repair or restoration is not promptly made. The doctrine, familiar to English courts but never hitherto adopted here, that the acts of a superior officer or workman under a corporation are as those of the employer, and the latter is responsible for negligence involving disastrous results, was affirmed. The case was that of a railroad engineer who lost his life while saving his passengers from an accident, the result of a defect in his engine to which he had called the attention of the master mechanic. His widow sued the railroad, the Texas and Pacific, for $80,000, but was ruled out of court in Texas. *Leffel's News* thinks the lady will probably be more successful on the retrial which has been ordered.

Operating Elevated Railroads by Electricity.

We learn from our foreign exchanges that the Council of Magistrates of the city of Berlin have appointed a special committee of engineers and architects to examine into and report upon the proposal submitted by Siemens and Halske for the construction of an electric railway across a portion of the capital. It is intended to begin the line at Belle Alliance place and run it through Friedrich and Chaussee streets on to Wedding place. The tracks—one for the up and the other for the down trains—will be supported by iron columns, 14 feet 9 inches high and 33 feet apart. The carriages are to be narrow and short, having only ten sitting and four standing places. The electro-dynamic machine to move the train will be placed under the floor of the carriage between the wheels, and a steam engine of 60 horse power to produce the electricity will be placed at the terminus. There will not be many stoppages, and the rate of speed is estimated at about twenty miles an hour.

INSANE INGENUITY.

Stephen M. Pillsbury, Jr., of Chelsea, Mass., an unmarried man of thirty, with a hereditary taint of insanity, guillotined himself April 20. He is described as a temperate, retiring sort of fellow, in prosperous circumstances, and on good terms with his family and friends. His special weakness was a morbid taste for reports of criminal matters and suicides. Evidently his desire was to do something notable, but owing to feeble health and probable lack of physical courage, he could see no way to distinguish himself except by suicide. Accordingly he constructed an apparatus like that figured herewith (copying a contrivance used for a like purpose in a Western State five or six years ago), and deliberately cut off his own head. He set up his apparatus in the barn, using therefor such materials as were handy. The standards were joists, A A, extending from the floor to the loft, to the under side of which they were securely spiked, a brace, B, adding to their stability. The lower ends of the joist were mortised in a block of hard wood, the top of which was rudely hollowed out at H to support his neck. Boxes of stone, J J, on either side kept the apparatus steady. Fitted between the uprights, so as to slide easily, was a piece of two inch plank, to which was fastened the blade of a broadax, E. On the top of the slider was a box, C, loaded with stone. A lever, F, pinned to the left upright supported at one end the slider, balanced by a watering pot, G, at the other end. A broom handle, K, thrust through the supports near the base served to hold the suicide's head in place, and a leak in the watering pot let off the guillotine when he had stupefied himself with ether placed under his nose in the trough, I. The apparatus answered its purpose reasonably well, and probably could not have been put to any better use. We are not sure, however, that it would not be well to re-enact the old custom of midnight burial at the crossroads, stake and all, for such as make an end of themselves in such untidy and, to their friends, shocking ways. With so many means at command for decently slipping off the mortal coil bodily mutilations are not to be tolerated.



PILLSBURY'S GUILLOTINE.

MISCELLANEOUS INVENTIONS.

Mr. Goldsborough Robinson, of Louisville, Ky., has patented a process of treating leaf tobacco for improving its color and quality, which consists in immersing the tobacco in alcohol and then drying it.

Mr. Charles Coon, of Saugerties, New York, has patented a process of repulping paper, which consists in causing the beater engine to operate upon the same while suspended in a hot bath.

Messrs. John S. Headen and John I. Spainhower, of Pleasant Hill, Mo., have patented an improvement in that class of boiler washing machines in which an oscillating lever or analogous device is employed to press or squeeze the clothes, said lever working in a clothes receptacle having a perforated semicircular bottom and placed in a sheet of galvanized iron boiler that is intended to be set over a fire.

Mr. Andrew J. Clark, of Little Falls, Minn., has invented an improved book for holding blank forms, the object of which is to preserve the blanks in good condition, and to enable the different kinds to be readily and quickly referred to and taken from the book.

Mr. Merrill R. Skinner, of Foster Brook, Pa., has patented a swivel hook for connecting and tightening ropes and cables without removing them from the pulleys or shafting, and which is simple in construction and effective and convenient in use.

An improved ice pitcher of simple construction, with a removable lining of porcelain, has been patented by Mr. Herman Vasseur, of Wallingford, Conn. The invention consists in an ice pitcher containing a removable lining of porcelain, glass, or similar material resting upon the detachable bottom of the pitcher.

Mr. Jasper T. Cronk, of Hoboken, N. J., has patented a simple and convenient means of adjusting a clothes line and hanging the clothes from a window. The invention is an improvement on the line fastener for which Letters Patent No. 186,991 were granted to the same inventor February 6, 1877.

An improvement in pianoforte agraffes, patented by Mr. Edward T. Bowlby, of Dixon, Ill., relates particularly to improvements in the agraffe which clasps the strings to the bridge on the sounding board; and the object of the improvement is to prevent the disagreeable jarring of the strings caused by the springing of the frame of the instrument and the setting of the bridge and sounding board.

Mr. William Harkins, of Dunkirk, N. Y., has patented a car coupler formed of a drawhead having an extended arm and a coupling bar at one side with a recess between. A horizontal key is propelled by a pinion gearing into a rack on the key or by a spring. The pinion has a lever arm attached to it which, when the key is set, extends across the recess, so as to be struck by an entering bar of the opposite coupler. When this lever is struck the key is thrown forward by the combined action of the revolving pinion and spring or by the pinion without the spring, and passing through a slot of the coupling bar, holds the cars coupled.

IMPROVED WINDMILL.

The windmill represented in the annexed engraving has its wheel mounted on a vertical shaft, in a strong, well-braced, octagonal timber tower, provided with shutters which may be opened or closed to control the motion of the wind wheel, or to stop it altogether, as circumstances may require. The shutters are hung loosely so that they will open by the force of the wind.

The wheel consists of upper and lower radial arms extending from hubs placed on the vertical shaft. Between these arms are secured vanes or paddles, which are set at a suitable angle to receive the wind; the outer vane inclining inward from the end of the arm at an acute angle, and the others placed behind and parallel with it. By this arrangement the air passing through the wheel is utilized to the greatest extent: striking the first vane on the outer row, it is guided to the second vane on the second row, and from this to the third vane on the inner set, and so on.

In a mill of this construction the wind from any direction may be utilized to the fullest extent. The wheel and tower are simple and inexpensive, and the mill is adapted to general use.

Wind power is certainly cheaper and more universal than any other, and the machine shown in the engraving seems well adapted for utilizing it.

Further particulars may be obtained by addressing the inventor, Mr. Thomas Dwees, San Antonio, Texas.

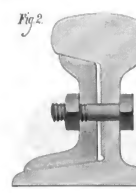
A Night Light.

A simple way to produce an illuminating composition is thus described in *Industry:* Cleanse oyster shells by well washing, expose them to a red heat for half an hour, separate the cleanest parts, and put into a crucible in alternate layers with sulphur; now expose the vessel to a red heat for an hour at least. When cold break the mass, and separate the whitest parts for use. If inclosed in a bottle the figures of a watch may be distinguished by its aid. To renew the luminosity of the mass place the bottle each day in the sun, or in strong daylight; or burn a strip of magnesium wire close to the bottle. The sulphide of lime will thus absorb light, which will again be available at night time.

IMPROVED RAIL.

The annexed engravings represent an improved rail recently patented in this country, also in England, France, Germany, and Belgium. It is intended to avoid the noise and jarring common to the ordinary forms of rail by preventing the depression of the ends of the rails at the joints. This construction, besides conducing to the speed, safety, and comfort of travelers, and increasing the durability of the track, adds to the durability of the rolling stock and machinery run upon it.

Fig. 2.



VAUGHAN'S IMPROVED RAIL.

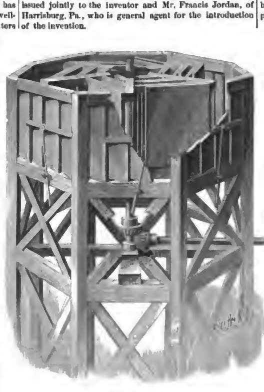
The mechanical construction will be understood from the engravings, Fig. 1 being a perspective view, and Fig. 2 a transverse section.

Fig. 1

VAUGHAN'S IMPROVED RAIL.

The rail is made in two parts, one of which is similar in form to the ordinary rail, the difference being that one side is channeled deeper than the other, and the channel is beveled to receive a re-enforcing bar, which is also channeled and breaks joints with the rail proper so that the whole is as rigid at the joints as elsewhere. A little space is left between the vertical adjoining faces of the two parts of the rail to admit of a perfect bearing at the upper and lower edges of the inserted piece, and there is a small semicircular groove at the juncture of the base and web to relieve the sharpness of the angle.

This improvement is the invention of Dr. A. C. Vaughan, of Shane's Crossing, Ohio. The foreign patents are to be issued jointly to the inventor and Mr. Francis Jordan, of Harrisburg, Pa., who is general agent for the introduction of the invention.



DWEES' WINDMILL.

The Kuro-Si-wo not like the Gulf Stream.

According to the recent report of W. H. Dall, Acting Assistant of the U. S. Coast Survey on the Pacific coast, the Kuro-Si-wo, or Japanese warm current, is not marked in its approach to the American coast by sharply defined walls of water temperature such as characterize the Gulf Stream of the Atlantic. It is not at all like a river flowing in its bed. There is a general drift which is reversible and intermittent when opposed by storms, and which shades off from a temperature of 65°. That part of the Kuro-Si-wo having a temperature of 55° approaches the northwest coast in the vicinity of Vancouver Island. There is a deflected arm of this current known as the Alaska current, which has a temperature varying from 50° to 55°. The shoal waters of the Behring Straits on the eastern side appear to be warmer than on the western side. But Captain Dall says that there is no proof that there is a warm current flowing up through the straits. The whole Pacific coast, however, from Unmak in Alaska, to Vancouver is bathed by a sea with a summer temperature varying from 48° to 55°.

The winter along a coast of this temperature never can be severe. There is a great precipitation of moisture, but only a moderate degree of cold until the interior of the country is reached. Southeastern Alaska has been described by recent explorers as having more than a tolerable climate. For a considerable part of the year it is pleasant and altogether agreeable. It is essentially that of Vancouver. The exhalations of moist air are drifted inland. Vegetation is rank, and a great deal of the land can be made very productive. It is not to be supposed that the influence of the Kuro-Si-wo is lost after passing Vancouver in a southerly direction. It no doubt has some influence all along the Oregon coast, and greatly aids in the precipitation of moisture in Washington Territory and Northern Oregon, and in producing the fogs of the California coast.

MECHANICAL INVENTIONS.

An improved nut lock, patented by Messrs. Amandes Hackman and George W. Tinsley, of Blakesburg, Iowa, consists of a bolt having a longitudinal groove cut across its screw threads, in combination with a nut having a thin raised annular collar or flange, that fits about the bolt and may be pressed into the groove of the bolt for the purpose of locking.

A baling press so constructed that the head block can be moved to one side to uncover the top of the baling box, and that the direction of motion of the follower can be changed while the driving shaft moves continuously in the same direction, has been patented by Mr. Alexander McN. Paxton, of Vicksburg, Miss.

Mr. Henri Burin, of New York city, has invented a tool for cutting off metal rods, bars, or shafts, and also for cutting screw threads, and especially intended for heavy work. The inventor makes use of a cutter head fitted for being revolved by a hand crank and gearing on a base or support that is to be clamped around the bar or shaft. The cutting tool travels around the shaft or rod, and is set up by a screw as the work progresses.

A novel and efficient rock drill, wherein the drill is fed and turned automatically, and is operated in delivering a blow by the full force of the propelling power, has been patented by Mr Arthur W White, of Buffalo, N. Y.

Mr. Kimp Hill Higginbotham, of Waterford, Miss., has patented a water wheel, so constructed that it can be run with a very low head of water, and can be stopped and started automatically.

Mr. Joseph V. Morton, of Winchester, Ky., has patented a sewing machine motor, so constructed that sewing machines may be driven by hand power or by foot power, or by both hand power and foot power, as desired.

Signaling by Illuminated Steam.

A new method of signaling at sea has lately been tested in England by the Trinity Board, with great promise of beneficial results. The system was devised by Carl Otto Ramstedt, late of the Russian navy. The apparatus consists of a dished chamber, in which the inventor burns strontium or other substances so as to produce a variety of colors if desired. At the back of the chamber is a reflector, by means of which the light is thrown on the steam either steadily or in flashes at will. The steam thus becomes a luminous mass, varying in color with the substances used in combustion. In practice the light is thrown upon the steam issuing from the funnel of a steamer, and optical signals are made according to any known code of signaling, such as by combinations of flashes of longer or shorter duration. This is effected by the light apparatus being closed in at the front with a hinged cover, which is manipulated by the signaler according to arrangement. The result of the experiments showed the system to be very effective and applicable to its intended purpose, and there appears to be little doubt that it will prove of value as a means of signaling at sea.

The advantages of the invention are not limited to steamers, as it is equally applicable to sailing vessels, in which the light might be thrown upon the sails.

Useful Shams.

Under the above heading, which we think an inappropriate one, as most of the articles named are not only useful substitutes, but in some cases superior to the genuine article for use in the arts, Mr. P. L. Simmonds, in the *British Trade Journal*, remarks as follows:

One of the most noticeable features of modern times is the immense progress which has been made, and the manufacturing ingenuity and scientific skill displayed, in finding substitutes for expensive or scarce raw materials and articles in general demand. The fact is apparent beyond question that art is fast invading the domain of nature. Chemistry is enabling us to replace animal and vegetable dyes, and to form artificial gems, or creditable imitations; mineral oils replace animal and vegetable ones for illuminating purposes, and the electric light is treading upon the heels of gas.

The expensive outfits for the whale fisheries are comparatively abandoned, whalebone and blubber from the huge marine mammals being less in request; coral insects may proceed with their submarine constructions unmolested; the sea tortoise will be pursued less eagerly for its carapace; the ostriches of the desert be less sought after; and even the great pachyderms of India and Central Africa can be spared to be more usefully employed in extending the march of commerce. Under our enlightened civilization we can now manufacture our own whalebone, coral, tortoise shell, ivory, and feathers, without the need of penetrating into wild jungles and arctic or tropical seas for our supplies. The extinction of whalebone in commerce will not deprive us of our umbrellas, or the female sex of their parasols and corset busks. Rattans have been converted into wallosin, and horn shaped into pliable bones, while steel ribs also do duty effectually for baleen.

Ivory, being an expensive material and in continual demand, has formed the subject of many patents for good substitutes, but those tried have generally had more the appearance of an opaque cement than the natural dentine. The best and most effectual imitation, which takes a good polish, is the American substance passing under the name of "celluloid."

Celluloid is one of those inventions of recent origin which has become a substitute for many natural raw materials. It is a species of solidified collodion produced by dissolving gun cotton in camphor with the aid of heat and pressure. The applications of celluloid are now legion. As a substitute for ivory it is best known, and so perfect is the resemblance that a close inspection is required to distinguish the counterfeit from the genuine; the absence of the grain, or decussation, is the chief distinction. Celluloid possesses not only all the strength and elasticity of ivory, but it does not warp nor discolor with age.

It is much used in making combs, backs of brushes and hand mirrors, frames for looking glasses and portraits, handles for knives and forks, piano and organ keys, and billiard balls, which are said to be equal in elasticity to those of ivory. One advantage it has over ivory is that it may be moulded, so that the most delicate and elaborate articles can be made with it at a fraction of the cost of true ivory. An endless variety of colors can also be given to celluloid by the admixture of proper pigments.

In imitation of tortoise shell it is made into such articles as combs, card cases, cigar cases, napkin rings, etc. The pink coral so popular for jewelry is admirably imitated with it, and so are malachite and amber mouthpieces for pipes, cigar holders, and musical instruments.

Beautiful fancy ornaments are made of artificial tortoise shell, which is formed by melting gelatine at a moderate temperature with a small amount of metallic salts, running the whole into moulds, and staining the mass with hydrosulphate of ammonia, so as to produce an imitation of the grain of natural tortoise shell. The appearance of tortoise shell may also be given to horn by brushing it over with a paste made of two parts of lime and a little soda lye, which is allowed to dry. This forms sulphuret of lead with the sulphur contained in the albumen of the horn, and produces dark spots, which contrast with the lighter colors of the horn.

Among minor products which have been successfully imitated are meerschaum, horn, and coral, by the pulp of potatoes, turnips, or carrots, treated with sulphuric acid.

Ostrich feathers, which, as the coveted court plumes of fashion have always been in demand at high prices, are not only getting more plentiful by the domestication of the bird, instead of hunting it down in its wild haunts, but imitations of all kinds have sprung up—those of spun glass sold at from 2s. to 8s. each instead of 10s. to 20s.; those made of silk, etc. It has heretofore been the custom to work up all the odds and ends of ostrich feathers into plumes, and even to make use of the feathers of other birds. But it was left for Yankee ingenuity to get up an imitation, the component parts of which are silk on a rattan or celluloid quill. This "sham" could be easily passed off on ladies as genuine, and almost defies detection by others than experts.

Cloth, in imitation of furs and skins, is now made from mohair or goat's wool, and the resemblance is so good that at a few yards' distance it is difficult to tell whether it is real or imitation. It is colored to resemble seal, beaver, otter, and chinchilla, and lately there has been quite a quantity made in imitation of ostrich feathers, and used very largely for trimmings on dresses and mantles. At the last Paris Exhibition there was an imitation white squirrel shown, shaded to a light fawn.

The manufacture of imitations of precious stones has long been an important industry in France, but it has increased enormously of late years, on account of the perfection attained in the art; and at present the supply cannot keep pace with the demand for fictitious gems. A revolution has been brought about lately in the manufacture of artificial diamonds by substituting a preparation of gold for the oxide of lead in making the strass, and further, the stones when cut are subjected to a chemical process by which the refractive power is made equal to that of diamonds of the purest water. These perfect stones attracted great attention in the last Paris Exhibition, where they were exposed side by side, and in the same cases, with real diamonds of great price. Whether the latter can ever be artificially made on an extensive scale is still a matter of dispute, although its possibility is claimed. Any man can convert a diamond into charcoal, but it is not so easy to turn charcoal into diamonds. The recent claim of Mr. MacTear, of Glasgow, to have crystallized carbon is acknowledged, but the diamonds produced are as yet too minute to affect the value of natural ones.

Artificial pearls have long been manufactured with the greatest skill and ingenuity, and so close is the imitation that alternate strings of false and genuine shown by jewelers can scarcely be distinguished. Mourning jewelry of black glass has replaced the more expensive jet ornaments among the lower classes.

Numerous patents have been issued from time to time for making imitation marble, which in practice have been more or less successful; by some of these an almost perfect imitation of the various shades and colors of marble is obtained, and slate is made to imitate marble. Artificial stone is now made to any extent.

Within the last six or seven years a complete revolution has taken place in the substitution of artificial alizarine for the natural alizarine of madder. The culture of this dye root has almost been abandoned now in the producing countries where it was formerly grown. The product from an agricultural industry which yielded yearly over £2,000,000 in value has been entirely replaced by a chemical.

As a dye, alizarin is now, at most, not more than one-third of the average price of madder in former years. The "green grease," one of the last portions of the distillation of coal tar, was formerly an impurity, and valueless; instead of being thrown into the gutter, this by-product has become a valuable commodity which has largely benefited our gas works, England being the great tar producing country. The new color obtained from it does away, too, with the necessity of separately mordanting the fabric to be dyed.

From the light coal tar oils a whole series of aniline colors, of formerly unknown shades, have sprung up, exceeding in value £2,000,000 sterling annually. The estimated value of the production of coal tar colors, here and on the Continent, is about £3,250,000, and this industry has placed at the disposal of commerce products which, but for chemical research, could never have been obtained.

Ultramarine is another color which has made remarkable progress, although it is not a recent substitute, its manufacture dating from 1828, when it was discovered by Guimet; in 1830 the blue prepared from lapis lazuli cost £60 the pound; now the yearly production of ultramarine in Europe (chiefly in Germany and France) is over 22,000,000 lb., sold at less than 1s. the pound.

A cheap substitute for silver has been found in aluminum made from bauxite, at a cost of 20s. the lb.

When the war with Russia rendered bristles scarce and dear, commerce soon supplied our brushmakers with vegetable substitutes in the shape of kittool fiber and coir fiber from palms, Mexican fiber from the leaves of *Agave sisilana*. Piassava fibre from the leaf stalks of a South American palm came in to supply bass brooms, chimney sweepers' brushes, and street sweeping-machines. Even split quills have been brought into requisition for brushes, and for white and dyed bristles we are not alone dependent upon the stiff hair of the hog.

Another cheap substitute brought into use is that of vegetable down, to replace the costly animal product, eider down. These silky downs, clothing the seeds of several plants, such as *Bombax, Ceiba, Calotropis*, etc., are now largely used for filling coverlets, ladies' quilted petticoats, muffs, and other articles. This vegetable down is 50 per cent cheaper than the feather down. The qualities which recommend it for use are immunity from attacks of moth and vermin, lightness, elasticity and softness, medium warmth, and cheapness.

The manufacture of oleomargarine, or artificial butter, has already reached the status of an important industry, both in America and on the Continent. The production of oleomargarine is carried on on an extensive scale in large establishments, where great quantities of fat can, by special machinery, be treated cheaply and with uniform results, while the churning of the oil with the milk, and the subsequent processes necessary for its conversion into butter, are the work of numerous small factories.

Besides the use of oleomargarine for the manufacture of artificial butter, it finds another extensive channel in the manufacture of cheese, being added to skim milk and rennet. The cheese produced is said to be palatable, and to make a healthful article of food.

Gas bids fair to be replaced ere long by the electric light, judging by the progress Mr. Edison has made with his electric lamp.

Careful thought and ingenuity are always on the search to utilize waste products, and to find substitutes. For instance, there is a large demand for eggs for various manufacturing purposes—for glace leather in glove making, book binding, photographing, calico printing, clarifying liquors, etc., in the form of albumen, and the yolk of the egg, etc.

Large premiums have been offered for a good substitute for egg albumen, but no really efficient substance has yet been discovered. In glove making a mucilage obtained from the root of the marsh mallow has been tried. Some manufacturing processes require the white of the egg, some the yolk. At least four eggs are required to clarify every barrel of wine; and when the production of wine in France and other continental states is considered, the demand becomes extensive, reaching hundreds of millions of eggs. Some of the seaweed isinglass might certainly be used for this purpose.

There is no end to artificial productions, and the list might be extended indefinitely, including artificial ice, which renders us independent of King Frost; artificial sugar, which we can make from starch or rags; artificial fruit essences, artificial horn from seaweed, artificial wood from compressed sawdust or straw, artificial leather from old scraps or the leather cloth, artificial parchment from paper chemically treated with sulphuric acid, and as hides for leather become more in demand, we have come to utilize the formerly neglected skins of the alligators, the snakes, the kangaroos, the porpoise and other sea mammals, and fishes.

Use of the Blowpipe with Closed and Open Glass Tubes.

BY C. J. NULARS.

Very important results are obtained by heating substances under examination in closed or open glass tubes. They should be of hard German glass, as this does not readily soften under heat, nor become discolored, like ordinary flint glass, by a deposit of reduced lead. The most convenient size for the closed tube is 3 inches by 3 or 4 10ths; of the open tube, 4½ inches by 2-10ths.

The Closed Tube.—The phenomena to be observed in using the closed tube are: 1, Decrepitation; 2, change of color; 3, phosphorescence; 4, deposit of condensed aqueous vapor; 5, deposit of a solid sublimate; 6, fusion; 7, evolution of gas or vapor, which may be colored, alkaline, acid, or odorous. Sometimes it is advantageous to have the tube bulbous at the bottom. It should be rendered dry before use by warming it over the spirit-lamp, and also be quite clean. The assay may sometimes be in powder, sometimes in the shape of a small fragment, according to circumstances. If in powder, the powder should be introduced so as not to soil the sides of the tube. The charged tube should be first heated in the flame of a spirit-lamp, and in most cases the heat be subsequently increased by exposure to the blowpipe flame. To test the acidity or alkalinity of any condensed moisture or uncondensed vapor, small strips of moistened turmeric or litmus paper should be inserted in the mouth of the tube.

EXPERIMENTS.

Witherite, simply heated by means of spirit-lamp, decrepitates, yielding watery vapor, which condenses in the upper part of the tube.

Nothing but the existence of water in the mineral is proved by this experiment.

Gypsum, heated by spirit-lamp, afterward by blowpipe flame, becomes white, and is converted into plaster of Paris. Water condenses in the upper portion of the tube.

The behavior and result are characteristic of gypsum.

Fluorspar, heated by spirit-lamp, phosphoresces in the dark, and decrepitates, yielding a little water sometimes.

Behavior is characteristic.

Nat. Alum, heated by blowpipe flame, gently at first, strongly afterward, intumesces and yields much water. When strongly heated sulphuric acid is evolved, which reddens litmus paper.

Turquoise, heated by spirit-lamp, yields water, turns black, and sometimes decrepitates.

Wavellite, heated by blowpipe flame, yields water and hydrofluoric acid, which corrodes the glass.

The presence of fluorine is proved.

Iron Pyrites, heated by blowpipe flame, yields much sulphur and some sulphureted hydrogen; detected by its odor and its action on acetate of lead paper.

Mispickel, heated by blowpipe flame, yields a red sublimate of bisulphuret of arsenic, and also metallic arsenic.

Pyrolusite, by blowpipe flame, when strongly heated, gives off oxygen, which may be recognized by its action on a splinter of ignited wood inserted in the mouth of the tube.

It increases the glow of the splinter, or causes it to burst into flame.

Nickel glance, heated by blowpipe flame, decrepitates, and yields an orange-colored sublimate or tersulphide of arsenic.

Ullmannite, heated by blowpipe flame, yields a white sublimate of antimonous acid, and some tersulphide of arsenic.

Calamine, by blowpipe flame, strongly heated, evolves carbonic acid gas, which may be recognized by its action on an ignited splinter of wood inserted into the tube. It extinguishes it immediately.

Jamesonite, by the blowpipe flame, fuses, and yields sublimates of sulphur, sulphide of antimony, and metallic antimony.

ACCORDING to Professor Church, withered leaves of the usual autumnal colors—yellow, red, or brown—can be rendered green again by steeping in water along with a little zinc powder.

A Poisoning Case with Lessons.

An interesting poisoning case came before the Coshocton County (Ohio) Court, at the February term, in which a woman was charged with administering arsenic to her husband, who died the 13th of August, 1879, with all the symptoms of arsenical poisoning. The body was exhumed on the 26th of August, the abdominal viscera removed and submitted to Professor C. Howard, of Columbus, for analysis, who reported traces of arsenic in the stomach, intestines, and kidney, and four-fifths of a grain in the liver.

The professor was of course an important witness in the trial, and his examination elicited some facts which are not without interest to chemical students. The tests he used were Reinsch's and Marsh's. He described the manner of distinguishing the metallic spot of arsenic on porcelain from that of antimony, relying on the hypochlorite of sodium solution and the nitrate of silver tests, together with the production of the octahedral crystals which have always been considered so highly characteristic of the arsenical sublimate. The defense created a doubt in the minds of the jury as to the reliability of Professor Howard's analysis, by showing on cross examination that a work on jurisprudence considered the hypochlorite of sodium test of the arsenical spot as wholly unreliable, *as it would also dissolve the antimonial spot*, though slowly. The production of octahedral crystals was proven to be unreliable as a test for arsenic by a recent statement from Professor Wormley, that antimony sometimes will produce crystals *which cannot be distinguished in appearance from those of arsenic*. We are here taught the important lesson that some of the so-called reliable distinguishing tests for arsenic are not reliable, and the careful toxicologist should make use of more confirmatory tests. The attending physician testified that he had prescribed subnitrate of bismuth to the patient, and we have not the least doubt that the arsenic found in the viscera came from this medicine. What an important lesson to the pharmacist! Here was a woman on trial for murder; arsenic was found in her dead husband's remains, and circumstantial evidence pointed to her guilt, and yet we believe the cause of the whole proceedings was this treacherous subnitrate of bismuth. Every druggist should carefully test his preparations of bismuth and ascertain whether or not they are contaminated with arsenic. We are happy to state that the woman was acquitted.—*Phil. Hoglan in Pharmacist.*

The Action of Platinum on the Animal Organism.

The action of most of the metals on the animal organism is well known, but that of platinum has been but little studied, almost the only observations that we know being those of Höfer and Gmelin, made respectively forty and fifty years ago. This gap in our pharmacological knowledge has been, to a certain extent, filled by some researches of Dr. Fredk. Kebler, of Cincinnati, in the laboratory of Strassburg, and which have, says the *Lancet*, been recently published in the *Archiv fur Experim. Pathologie u. Pharmakologie* The observations relate to the action of platinum both on frogs and warm-blooded animals. The mode of administration was the subcutaneous injection of a solution of chloride of platinum neutralized by carbonate of soda. The chief effects on frogs were found to be—augmentation of the general sensibility; heaviness of voluntary movements; curving of the back when this or the head was stroked, sometimes with painful extension of the hind legs on cutaneous irritation; increasing paralysis of the voluntary movements; spontaneous convulsive spasms of the extremities, or individual groups of muscles; weakened muscular irritability; loss of consciousness; and death. From these effects it would seem that platinum paralyzes the voluntary muscles, but paralyzes their movements before it affects the muscles themselves, apparently in consequence of a specific action on the central nervous system. The heart appears much less affected than the voluntary muscles, being scarcely interfered with, when death occurs. In mammals, however, the action is somewhat different. The direct effect on the muscles is not perceptible. Death rapidly occurs from a paralysis of the abdominal vessels when a dose is administered such as might affect the muscles. In rabbits a copious diarrhea is produced, and in dogs there are vomiting and hemorrhagic stools. In the former, after death, the mucous membrane of the stomach and intestine is congested, and in the latter the congestion extends also to all the abdominal organs. The muscular irritability was in all cases preserved up to death. In both kinds of animals indications of general paralysis were perceptible soon after the administration of the poison. The results of the experiments seem to indicate that the action of the poison takes place upon the muscular fibers or the peripheral nerve endings of the vessels, most probably upon the latter. But the phenomena presented by frogs, and some of the characters of the weakness in mammals, suggest that probably platinum has also a specific action on the central nervous system, and the nervous symptoms are due partly to this, and partly to the local anemia. The fatal dose of platinum appears to be, for dogs 5 to 6 milligrammes, and for rabbits about 10 milligrammes of the body-weight of the animals experimented upon.

An Extra Mule.

Dr. Yandell, in a letter to the *Louisville Medical News*, speaks of a fertile female mule, now to be seen at the Jardin d'Acclimatation, Paris. She has brought forth no fewer than six foals—some by zebras, some by an ass, and some by a stallion.

Extraction of Perfumes with Chloride of Methyl.

BY PROFESSOR CAMILLE VINCENT, ECOLE DES ARTS ET METIERS.

Some months ago a manufacturing perfumer, M. Massignon, came to consult me respecting the employment of chloride of methyl (which has the property of dissolving fats, resins, and essential oils) in the extraction of the odorous principles of scent producing plants. I expressed my belief that it might be so employed, but told him that I had no *data* in point at my command.

An experiment subsequently made with scent-woods succeeded, but the product possessed a very unpleasant odor, the commercial chloride of methyl used for industrial purposes retaining a pyrogenous product with a very persistent odor. I therefore turned my attention to the purification of the methyl, which in itself has a sweet ether-like smell; and in this I succeeded perfectly by treating ordinary methyl chloride with concentrated sulphuric acid, which completely absorbed the unpleasant odor. Chloride of methyl liquefied after the above treatment was found to leave no odorous residue on evaporation; it is perfectly suited for the extraction of perfumes, and when subsequently evaporated, leaves them with their limpidity and delicacy wholly unimpaired. My first experiment was made with orange flowers in a glass vessel; and the product thus obtained was pronounced by several experts to be superior to neroli obtained in the ordinary way by distillation with water. Encouraged by the success which had thus far attended my efforts, I had an apparatus constructed of sufficient size to test the practical value of the discovery by operating upon several kilogs. at once of different kinds of flowers. It consisted of the following parts: 1. A digester, in which the flowers to be extracted were placed; 2. A receiver for the liquefied methyl chloride previously purified with sulphuric acid; 3. An air-tight vessel to receive the methyl chloride after passing through the flowers, in which a vacuum could be produced with the aid of an air pump; 4. An air pump to exhaust the last named vessel, and to drive the methylic vapor into a cold coil, whence it returns, in a liquefied state, into receiver 2. The air pump and coil formed part of an ice-making machine

The extraction of the perfume, as, for example, of roses, is thus performed. The digester 1 is filled with flowers. Upon these is turned, with the aid of a conical stop cock attached to receiver 2, a portion of the liquid chloride of methyl contained in the latter vessel. A couple of minutes are allowed for digestion, and then the liquid is run off into receiver 3. Another charge of methyl is given, which is filtered through the flowers into vessel 3, like the preceding, and so on until the flowers are supposed to be exhausted. The air-tight receiver 3 is now partly filled with the liquid methyl charged with the odorous principles of the flowers washed by it. Any portions of chloride remaining in the digester can be removed with the air pump and by passing steam through the residue of the flowers, receiving the watery vapor in a gasometer, the chloride in each case being returned to receiver 2 through the cold coil. The chloride of methyl charged with odorous principles in vessel 3 must now be evaporated *in vacuo*. For this purpose a current of water at 86° Fah. is passed round the vessel, while the air pump is at work. When the manometer attached indicates an internal pressure of half an atmosphere, the operation may be considered as completed. The air-tight receiver is opened, and the odorous principles are found in the residum of fatty matter and wax left by the evaporated methyl. Treated with alcohol cold, this residuum yields up the perfume of the flowers in its full potency and delicacy.

In this way may be obtained, not only the perfumes of flowers generally extracted by distillation, but also of others, as the jasmine and violet, which, on account of their easy destructibility, are prepared chiefly by *enfleurage* or maceration in fat. Specimens of the perfumes extracted with deodorized methyl chloride have been sent to the Société d'Encouragement. The results with all kinds of scent-producing plants, flowers, seeds, barks, and roots alike, show that the yield by the methylic process averages 35 per cent more than by ordinary distillation with water.

M. Massignon is erecting an apparatus on the above principle at Cannes, which will be capable of extracting 1,000 kilogs. (20 cwt.) of flowers daily, and which he hopes will be in work in the course of the present month. The refrigerator attached to the apparatus manufactures 60 kilogs. of ice per hour.—*La Nature.*

Brilliant Metallic Deposits on Glass.

The deposit of a silver mirror on the interior of glass balls and hollow vessels, by filling them with suitable silvering solutions, is an exceedingly simple operation, yielding most beautiful results. The film of silver, although very thin, is not without expense. Metals which form with sulphur precipitates having a brilliant metallic luster, may be employed in the same manner as silver, yielding varied and beautiful effects at little cost. Carl Mann, assayer in Pribram, describes the use of antimony and lead as follows:

When nitric acid is added to a concentrated aqueous solution of tartar emetic solution as long as a precipitate is produced, then filtered and the precipitate stirred into fresh water, the liquid formed is essentially a basic nitrate of antimony in suspension. On diluting a portion of this milky liquid and boiling, the precipitate dissolves in the hot and acid liquid. A little of this hot solution poured into a hollow glass vessel and cooled as rapidly as possible, by shaking or holding it under running water, the liquid becomes milky and deposits a very thin but perfectly homologous film of the antimony salt on the sides of the glass. On washing it out with cold water and passing sulphureted hydrogen gas into it, or pouring in a solution of the gas, the glass appears of a uniform faint yellow color; the sulphide of antimony formed adheres very firmly to the sides of the glass after washing and drying.

By repeating this procedure several times the film can be increased very considerably within certain limits. Such glasses appear of a beautiful golden color with a green reflection. The effect is very fine and pleasing.

If sulphureted hydrogen gas be passed into an aqueous solution of oxide of lead in excess of metaphosphoric acid, a portion of the sulphide of lead will, under the proper conditions, adhere firmly to the sides of the vessel in which it is precipitated. The vessel will then have different metallic colors by reflected light according to the thickness of the film, darker when thicker. By transmitted light such a glass has a yellowish brown color.

The lead solution may be prepared by dissolving 1 part phosphoric acid in 4 parts water, also a second solution of 1 part sugar of lead in 20 parts water, and a third of a strong decoction of saponaria or an aqueous emulsion of an ethereal oil such as turpentine or *oleum serpylli*. To cover a glass ball with this lead film, three volumes of the phosphoric acid solution is poured into the ball, then four or five of the lead solution, and as much of the saponine solution. The total quantity of the liquid must be sufficient to easily cover the interior on tipping it slightly. If a thin film of the antimony be deposited first the lead film adheres better. The sulphureted hydrogen gas is passed in and the vessel kept moving to bring it in contact with every part of the glass. It is afterwards washed and dried. P. N.

AGRICULTURAL INVENTIONS.

Mr. Raphael T. Semmes, of Atlanta, Ga., has patented certain improvements in plows, and more particularly in that class of plows in which the standard is made reversible and adapted to receive mould boards and turning plows or scrapers on one side, and bull-tongues, sweeps, or shovel plows on the other.

Mr. Ferdinando Poole, of Emporia, Kan., has patented an improved hedge fence layer, which is so constructed as to lay the plants at any desired compactness and at any desired closeness to the ground.

An improved grain thrasher and separator has been patented by Mr. Martin Williams, of St. Johnsville, N. Y. The object of this invention is to furnish combined grain thrashers and separators so constructed as to separate the thrashed grain from the straw more thoroughly than machines constructed in the ordinary manner.

A Ship Canal through Denmark.

A concession has been granted to Herr Dahlström for a ship canal from the Baltic to the North Sea, between the Bay of Kiel and Brunsbuttel, in the estuary of the Elb. Its depth throughout is to be 20 feet 9 inches, its width at the surface of the water 160 feet, and at the bottom, 64 feet, the banks consequently having a very gentle slope. Provision will, moreover, be made, by the adoption of a peculiar system of locks and reservoirs, for increasing the depth of the water to 25 or 26 feet whenever it may be desirable to do so, and this depth will allow of the passage through the canal of the heaviest German ironclad afloat—the König Wilhelm, a vessel of 9,603 tons displacement and the largest ship in the German Navy, drawing only 26 feet. The canal can, it is calculated, be completed in six years, and will, it is estimated, cost $3,750,000, or about $2,250,000 less than the estimates made a few years ago of the cost of constructing a canal 31 feet deep and 224 feet wide at the surface of the water. In size, it may be added, the proposed Baltic and North Sea Canal does not compare unfavorably with the Suez Canal, the width of this at the surface of the water being 172½ feet, the width at the bottom 70 feet, and the depth about 26 feet 3 inches.

A New Gatling Gun.

An improved Gatling gun has lately been exhibited by the inventor in England. It is capable of firing 1,000 shots per minute, and killing a man or a horse at a mile range. The gun has a compact appearance, can be taken to pieces, and easily carried about, can be applied to military or naval use, and the mechanism of it is simplicity itself. The revolving barrel has ten compartments, into which, as they whirl round, metal cartridges drop from a tall oblong case fixed over the center of the barrel. At each turn of the handle ten shots are fired, and their dispersion is accomplished by a sliding apparatus. The size of shot in different caliber guns of this class ranges from musket balls to half-pounders. By the use of this implement three men can do the work of 300 riflemen.

A Fast Locomotive.

A passenger engine built chiefly for speed has just been finished at the Baldwin Locomotive Works, for use on the Bound Brook route between New York and Philadelphia. It is intended to make the distance, 90 miles, in 90 minutes. Its driving wheels are 6½ feet in diameter, and there is but one pair. The weight of the engine is 84,000; and its water tank holds 4,000 gallons. The dimensions of ordinary passenger engines are: driving wheels 5 to 5½ feet; weighs 70,000 to 75,000 lb.; capacity of water tank 2,000 to 2,500 gallons.

In the course of the year there were 38 glass factories in operation in the State, each employing from 50 to 75 hands. In addition to supplying these works the glass sand pits along the Maurice River sell from 10,000 to 15,000 tons of sand for consumption in adjoining States.

The yield of greensand marls in the marl belt crossing the southern half of the State is large, and the supply is practically inexhaustible. No attempt was made to collect the statistics of lime burned in the State.

A large and valuable map accompanies the report, showing the leading features of the economic geology of the State.

THE COMMISSIONERSHIP OF PATENTS.

The President has nominated and sent to the Senate for confirmation the name of the Hon. Edgar M. Marble, of Michigan, to be Commissioner of Patents, in place of Gen. Paine resigned. It is understood that the new Commissioner takes his seat May 1.

This appointment will, we feel confident, give very general satisfaction. Mr. Marble is by profession a lawyer, and for a considerable time past has been Assistant Attorney-General of the United States in the Department of the Interior, where his labors have always been distinguished by marked ability. He is an enlightened and commanding man, in the prime of life—45 years—agreeable manners, sterling integrity, quick perceptions, and judicial mind. He believes in hearing both sides of a case carefully before deciding. We think that the interests of patentees and inventors will at his hands be promoted, and that the affairs of the Patent Office will flourish so long as he occupies the Commissioner's chair.

The retiring Commissioner, Gen. Paine, has been very successful in his management of the Patent Office, and his departure occasions general regret. During his term he thought it necessary to introduce a number of new rules of practice, some of which are regarded as mere additions to the length of official red tape. But it must be admitted that, as a whole, Gen. Paine's administration has been an able one. Some of his decisions in patent cases have a high value for their clear and original method of interpreting the law, and will always rank with the ablest documents among the official records.

THE EDISON LAMP TESTS.

To the Editor of the Scientific American:

Your correspondent, Mr. William C. Ramsdell, in his letter of April 9, in your issue of May 1, p. 281, shows that he is unacquainted with the very elements of the subject about which he writes, and criticizes the conclusions reached by myself and others only because he does not understand them.

In the first place he seems to think that electromotive force is the same thing as the energy involved or work done in a given circuit. If he had examined any of the text books on electricity he would have found that electromotive force expresses simply the specific power which any combination (battery or magneto-electric machine or the like) possesses for causing the transfer of electricity from one place to another. In a given couple, say a Smee battery, it is the same in a cell the size of a thimble and in one as large as a bath-tub.

It is very correctly measured by the product of the current into the resistance where these are known, but when its value is obtained we have *not* found that of the energy expended or work done in the same circuit. For the latter we must have the product of the current *squared*, into the time, into the resistance, into the constant .737335, if we would express the result in foot pounds.

Had Mr. Ramsdell been acquainted with these matters he would have been saved the absurdity of announcing that it would require the same expenditure of fuel to run twelve lamps as it would be needed to run one.

It is curious that this *reductio ad absurdum* of his own did not open his eyes. Why should he stop at twelve lamps? His own method of calculation would give him the same result with a thousand, or a million, and thus reduce the cost of lighting the country to that required for one lamp.

It is hardly necessary to point out that in the calculations made in our paper it was *not* assumed that the twelve lamps were in series.

Theoretically it would make no difference as to the total energy expended how they were arranged, but, of course, any one acquainted with the subject would know that to place them in series would introduce great practical difficulties. Our calculation as given is correct for an arrangement in parallel circuits; but Mr. Ramsdell's calculations are simply absurd. Yours truly,

HENRY MORTON.

Stevens Institute of Technology, Hoboken, N. J., April 23.

THE NATIONAL ACADEMY OF SCIENCE.

The spring meeting of the National Academy of Science was held in Washington, April 20-23. The attendance was small. At a private session an amendment of the constitution was adopted limiting the number of members in the future to one hundred. Major J. W. Powell and Professor William H. Brewer were elected members, making the prescribed number complete. Professor Alexander Agassiz, of Cambridge, was chosen Foreign Secretary in place of Professor F. A. P. Barnard, whose term of office had expired. The Council elected for the ensuing year comprises S. F. Baird, Wolcott Gibbs, Asaph Hall, J. E. Hilgard, Clarence King, and Simon Newcomb.

Quite a number of scientific papers were read. The first was by Professor A. Agassiz, on "The Sea Urchins of the Challenger Expedition." A paper by Professor A. S. Packard, Jr., on "The Internal Structure of the Brain of Limulus Polyphemus," was read by Dr. Coues. Prof. O. C. Marsh discussed at considerable length "The Size of the Brain in Extinct Animals," reaffirming the law of brain growth enounced by him two or three years ago. Mr. D. P. Todd, of the Nautical Almanac office, in a paper on "The Use of the Electric Telegraph during Total Eclipses Applied to the Search for Intramercurial Planets," gave a plan by which observers of the eclipse of 1883 might telegraph their discoveries from station to station, and so confirm and extend each other's work.

On the third day of the meeting papers were read by F. M. Green on "The Telegraphic Determinations of Longitude by the United States Hydrographic Office;" T. S. Hunt on "The Taconic System of Geology;" S. P. Langley on "An Instrument for Measuring Radiant Heat, and on the Composition of Colors;" E. S. Holden on "The Nebula of Orion;" Theodore N. Gill on "The Distribution of Zeus Conchifera;" William Harkness on "The Solar Corona;" E. S. Morse on "An Early Race of Man in Japan." On account of the number of papers remaining for presentation, an extra session was held on the 23d.

It was decided to hold the Fall meeting in this city, beginning November 16.

NEW YORK ACADEMY OF SCIENCES.

At a meeting of the New York Academy of Sciences, held Monday, April 19, 1880, Prof. J. S. Newberry in the chair, Mr. I. C. Russell delivered an address on

RECENT OBSERVATIONS ON THE GEOLOGY OF HUDSON COUNTY, N. J.

From a study of the very large number of wells sunk in Hudson county, Mr. Russell had prepared a diagram showing the general stratification of rocks to be as follows: Shell heaps accumulated by the aborigines, sand dunes, glacial drift, red shales and sandstones, trap rock, sandstone and shales, serpentine, quartzite, and gneiss.

A large portion of the address was devoted to tracing the trap rock formation from the Kill-von-Kull, along the Bergen hills, the Palisades along the Hudson, and up to Haverstraw, where it reaches the height of a thousand feet. The general dip of the formation is 15° to the northwest. Both above and below it are found strata of triassic shales and sandstones. Specimens were exhibited showing the metamorphosis of these rocks where they came in contact with the trap. The whole configuration of the trap rock formation will be understood, as was shown by a diagram, if we imagine a stream of trap coming up from below and crowding out the sedimentary rock before it, chiefly following the direction of the strata, but now and then breaking through and forming branches from the main stream. These would then be partially exposed by subsequent erosion. There is every evidence that the surface erosion of this vicinity was a tremendous one. Upon following out the slope of the strata on both sides of the Bergen hills, and calculating the height, it will be found that they must have once formed mountains at least seven thousand feet high. This agrees perfectly with the theory proposed by Dr. Newberry, that the whole continent in the vicinity of New York City was once far more elevated above the sea level than it now is.

The denudation of the trap on the Bergen hills by erosion, and especially by glacial action, has given rise to peculiar conditions of drainage. Numerous basins without any outlet were hollowed out in the trap and filled with drift by the glaciers. It is evident that in such localities there can be no natural drainage, but that all impurities will accumulate and exhale poisonous gases. Yet wells have been known to be sunk in the drift and the water was used for drinking. On the western slope of the hills the retentive character of the drift does not interfere with the drainage.

The address was full of detailed information and illustrated by specimens and diagrams. In commenting upon it, Dr. Newberry expressed his gratification that it confirmed his views concerning the igneous nature of the trap, and also concerning the former great elevation of this portion of the country. He reiterated his belief that the margin of the continent once lay seventy or eighty miles further out from shore, and that the channels of the Hudson, the East River, Newark Bay, etc., were once very deep ravines. Further evidence of this is found in the soundings of the Coast Survey.

Dr. Newberry then spoke on the

VEGETATION OF THE VICINITY OF NEW YORK IN THE TRIASSIC AGE.

The mouth of the Hudson river during the triassic age must have presented very much the same conditions as the Bay of Fundy at the present time. Being, as it were, the tube of a funnel, it must have been the scene of tremendous tides, and consequently it must have been a very unfavorable locality for the preservation of delicate plants. A comparatively large number of the coarser parts of trees and plants had been found in sedimentary rocks of the vicinity, and of these several specimens were shown, along with some finer ones from the slates in the neighborhood of Boonton. Dr. Newberry expressed the hope that further search would be made.

The main object of the communication was, however, to correct an error that was liable to find its way into print concerning a specimen, photographs of which had been shown him by Professor Cook, and which had been pronounced a lepidodendron found in triassic rock. It has been a well settled belief that lepidodendra became extinct with the carboniferous age. To show the correctness of this belief, Professor Newberry exhibited the photographs of the specimen, and then proceeded to show that it was not a lepidodendron at all. He drew a diagram upon the blackboard showing the characteristic elongated rhomboids with smaller rhomboids inclosed of the lepidodendra, and called attention to the fact that they were absent in the specimen.

C. F. K.

TORNADO IN MISSOURI.

On the night of Sunday, April 18, a storm of wide range and unprecedented severity passed over Missouri and parts of the adjoining States, developing locally numerous whirlwinds which caused frightful havoc and great loss of life. The storm was most severe in Southwestern Missouri. The town of Marshfield, containing 200 dwellings, was almost entirely destroyed, only about a dozen houses escaping unharmed by wind and the fires which broke out in the demolished buildings. Fully 100 persons were killed in the town and around it, and twice as many more were seriously hurt. The northwestern part of Arkansas and the southeastern part of Kansas also suffered severely. The little town of El Paso, Ark., was leveled to the ground, with considerable loss of life. Great havoc was wrought at Oakbower, Ark., where twenty-six houses were destroyed and several lives were lost. At Fayetteville, Ark., a tornado cut a narrow swath through the town, destroying or badly damaging every building in its track. About twenty business houses and several dwellings were demolished, and quite a number of people are reported killed and wounded.

The severity of the storm was felt as far north as Davis County, Iowa, where two whirlwinds caused much loss of property. One of these left a path of destruction twenty miles long and from fifty to three hundred yards wide. Much damage was done also in Illinois, Indiana, and Wisconsin.

The storm was most severe, however, as already noted, in Southwestern Missouri. Between Marshfield and Jefferson City several villages were more or less completely destroyed, and a large number of country houses were wrecked or demolished, and numerous deaths are reported from every quarter of the afflicted region. Among the curious incidents reported of the storm one dispatch tells of a child two years old which was found on the afternoon of the 19th in a treetop, where it had been nearly twenty-four hours. It was considerably bruised, but will recover. It was claimed by its parents, who lived two miles and a half from the southern portion of the town. The child's aerial flight must, therefore, have extended over three miles.

Professor John H. Tice, meteorologist, of St. Louis, went at once to the track of the storm to investigate its phenomena. In a telegram to the St. Louis *Republican* he says:

"Everywhere along the track of the tornado there is evidence of a wave of water flowing in the rear of the cloud spouts. At some places there are only faint traces of such a wave. At others the *debris* is carried up and over obstructions two or three feet high. These waves or currents flowed in the greatest volume up hills. There are places where the entire top soil is washed away by the currents. Fibrous roots and tufts of grass show their direction to have been up hill, and, what is more significant, from all points of the compass toward the top of the hill when the tornado was raging at the time and expending its force. No trace at any point can be found where they flowed down hill. Many level places are swept clean of soil. Leaves, grass, *debris* of wrecked buildings, and fragments of planks carried along by the current and left in its track arranged themselves longitudinally to the current.

"The following is vouched for by George Gilbert, of this place. He and his wife and four children were on a visit eight miles in the country, and the center of the tornado passed within five or six yards from where they were. A wave of water, apparently fifteen feet high, rolled in the rear of the point of contact of the cloud spout with the earth. It rolled over them in a second, and was icy cold, drenching them thoroughly. About two miles northeast of the town stones weighing from five to seven hundred pounds were lifted out of the earth and carried along some distance in the track of the tornado.

"J. H. Williams, presiding justice of the county court, and residing in Panther Creek Valley, tells me a stone fell in the center of a field belonging to H. Rose, the weight of which was estimated at two tons. It is not known whence it came."

The tornado, so far as is known, commenced in Arkansas, in Stone County.

Opening of the Canals.

The Erie and Champlain Canals were opened for navigation April 20, two weeks earlier than last year. A large fleet of boats were at Buffalo awaiting this event, something over 5,000,000 bushels of grain being stored there for early shipment to tide water. A considerable increase is expected in the number of steamers on the canal. From careful observations made during a trial trip from Buffalo to New York last summer, the State Engineer estimates that a steamer and consort can make nine trips while two horseboats are making seven, at a cost nearly $500 less. Counting this saving, with the profit on the two additional trips, the gain for the steamer and consort during the season would be $1,382, without considering return cargoes.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

For Sale Cheap.—A Good Patent, from which large profits can be realized, or will sell or exchange one-half for its equivalent. Property with clear title preferred. Patented in the United States, Great Britain, and Canada. Only those meaning business need address T. Rogers, 82 Hope St., Brooklyn, N.Y.

"BIG STORY—BUT TRUE."

NEWTONVILLE, MASS., April 2, 1880.
Messrs. GAUDER & CO.:
License and Sample Eastlake Clothes Stick received. Have sold 1,300 already, not all delivered yet. Biggest thing out. Sells like hot cakes. You can make any use of this you please. Big story—but true.
Yours, etc., KARL THAXTON.
County License and Sample sent, prepaid, for One Dollar. Circular Free. Address
GAUDER & CO., Birmingham, Ohio.

SEND STAMP FOR CATALOGUE
TOOLS
LATHES, FILES, VISES
TALLMAN & McFADDEN, PHILADELPHIA.

GEO. P. ROWELL & CO.

Newspaper Advertising Bureau

10 SPRUCE ST., NEW YORK.

GEO. P. ROWELL & CO. conduct an agency for the reception of advertisements for American newspapers. The most complete establishment of the kind in the world.

Eight thousand newspapers are kept regularly on file, open to the inspection of customers.

Every advertisement is taken at the home price of the paper, without any additional charge or commission.

An advertiser in dealing with the Agency, is saved trouble and correspondence, making one contract instead of a dozen, a hundred, or a thousand.

A book of 120 pages containing lists of best papers, largest circulations, religious, agricultural, class, political, daily, and country papers, and all publications which are specially valuable to advertisers, with some information about prices, is sent to any address on receipt of ten cents.

Persons at a distance wishing to make contracts for advertising in any town, city, county, state, or territory of the United States, or any portion of the Dominion of Canada, may send a concise statement of what they want, together with a copy of the ADVERTISEMENT they desire inserted, and will receive, by return mail, an estimate of the cost.

For such information and estimate there is no charge.

Orders are taken for a single paper as well as for a List; for a single dollar as readily as for a larger sum.

Geo. P. Rowell & Co. also publish the American Newspaper Directory (price $5) in which will be found a complete list of all American Newspapers, and a Gazetteer of the towns in which they are issued.

Paris, . . 1878
Australia, 1877
Phila., . . 1876
Santiago, 1875
Vienna, . 1873

J. A. FAY & CO'S WOOD WORKING MACHINERY

was awarded at the Paris Exposition over all competitors THE GOLD MEDAL OF HONOR. Also highest award at Phila., Santiago, Australia, and Vienna. It is

Original in Design, Simple in Construction, Perfect in Workmanship, Saves labor, Economizes lumber, and Increases products of the highest standard of Excellence.

Railroad, Furniture, and Agricultural Implement Shops, Planing Mills, etc., equipped at short notice, and the lowest cash prices. Send for Circulars.

J. A. FAY & CO., Cincinnati, Ohio, U. S. A.

For Young or Old.

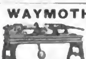
Do Your Own Printing.

$3 Press for cards, envelopes, etc. 14 other sizes, $8, $11, $25, $44, etc. Type setting easy by printed instructions. Do your own printing and advertising. Money made fast in any place jobbing or running a paper. Catalogue of Presses, Type, Cards, etc., for 2 stamps. Kelsey & Co., Man'f'rs, Meriden, Conn.

FOR SALE—PATENT No. 135,490. Patented Feb. 4, 1873. Device for Pitching Boats. Best machine out for the business. Address
W. H. RICHARDSON, Patentee, Stillwater, Minn.

MACHINERY FOR SALE. Three large lathes, also one large planer. For particulars, address THE HARTFORD FOUNDRY AND MACHINE CO., J. B. HUNTER, Prest., Hartford, Conn.

WAYMOTH LATHE.



Latest Improved. Rotary and Stationary Bed Planers and Buzz Planers; Band Saws, Wardwell's Patent Saw Bench, Dowel Machine; Chair Machinery; Boiler Machines, etc. Also large stock of Second-hand Machinery always on hand. Send for catalogue, and state just what you want, to ROLLSTONE MACHINE CO., 48 Water St., Fitchburg, Mass.

Beatty's Latest Offer.

Beatty's best Parlor Organ, for the Home of the Millionaire.

BEATTY ORGAN, Style No. 3000. This beautiful organ like cut contains fourteen (14) Stops, three sets of Golden Tongue Reeds, Beatty's Patent Stop Action, found in no other make, five octaves. Height, 76 ins.; Depth, 24 ins.; Length, 48 ins. Weight when boxed about 300 lbs. "Beatty's Best" is conceded by good judges of musical instruments, to be the most perfect organ manufactured. It not only contains all the latest improvements, but for style, finish and durability, it has no equal. The action or musical part is fitted up with **Golden Tongue Reeds**, which have, by years of trial, proved to be the most durable as well as the most musical. It also contains "Beatty's Patent Stop Action," the latest and most improved stop action in the world. It is attached to no other instrument except Beatty's, and is the greatest improvement yet made in an organ. The case is of solid black walnut, finely constructed, ornamented with French veneered panels, and finished up in **Grand Style**. It has a sliding lid, ornamented lamp stands, and conveniently arranged handles for moving. Its bellows, which are of the upright pattern, are of great power, and are fitted up with steel springs and the best quality of pedal straps. The **pedals, instead of** being covered with carpet, are made of metal and are of neat design, and never get out of repair or feet worn, like carpet. Other Manufacturers' price, about $400.00

☞ **My price in any new locality, in order to have this Style introduced, boxed and shipped with Stool & Book, ONLY $125.00**

RE-ELECTED MAYOR, on expiration of my first term as Mayor of Washington, the high honor of a re-election to the position of its Chief Magistrate of my thriving city by an increased majority, was again conferred upon me. To my many friends who have suggested my name for Congressional Honors, I will say, that my immense business interests will compel me to decline. The name of "Beatty" is known wherever civilization exists, as the man who first brought the prices of Pianos and Organs within the reach of the masses. He it is who has received more abuse from rival manufacturers and Agents than any other man on the face of the earth. Having shrunk from no labor, spared no energy, spared no expense, I am still determined that my fellow countrymen shall not pay the Monopolists' prices. My record in behalf of my fellow men at home, the poor, the church, the sabbath school, let others speak. Not alone in my own land, have I enjoyed distinguished honors, but also in the Palaces of Kings and Emperors in the old world. (See "Beatty's Tour in Europe.") Only a few years ago I left my father's plow, without a dollar. To-day I own one of the largest Piano and Organ factories in the World, Cor. Railroad Avenue and Beatty Street, Washington, New Jersey. Why? Because I sell first class goods at low prices. Quick sales and small profits, honest and fair dealing to all men, is the secret of my great success. Beware of Agents, I have no agents in large Cities but sell directly from the factory.

BEATTY PIANO Style No. 2020, 7 Octaves, Agraffe Treble, fine rosewood, all latest improvements. The price of this piano boxed, and shipped with Stool, Cover and Book, only **$210.** "The Pride of the Parlor" a magnificent 3 string instrument only **$297.50.** Beatty's best Chapel Organs, only **$130.**

Always remit by Post Office Money Order Draft, on New York or Express. Money refunded if unsatisfied, and freight charges paid by me both ways. **Labor and material are advancing.** Now is your time to order. Be sure to read my Latest Illustrated Newspaper & Catalogue before you purchase elsewhere. Sent Free.

If you do not want an instrument for your own home, advise your Friend to buy one. Every instrument when introduced, sells another. **It becomes a standing Advertisement.** Please show this Advertisement to your neighbors who are talking of buying an instrument.

Address all orders to **DANIEL F. BEATTY, Washington, New Jersey.**

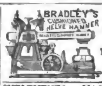
ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.

Steam Fitters' & Plumbers' Supplies.

STURTEVANTS' FAN BLOWERS.
ALBERT BRIDGES, 46 Cortlandt Street, New York.

COE BRASS MFG. CO.
WOLCOTTVILLE, CONN.
BRASS AND COPPER IN SHEETS
MATERIALS FOR METALLIC AMMUNITION A SPECIALTY
WIRE AND BLANKS



BRADLEY'S CUSHIONED HELVE HAMMER
Has More Good Points, Does More and Better Work, Takes Less Power, Than any Hammer in the World.
BRADLEY & COMPANY, SYRACUSE, N.Y.

IMPLEMENTS, MACHINERY, ETC. Catalogues, prices and Agency terms solicited. Unexceptional references. OSKAR NETZLER, Agent in Brisbane, Queensland, Australia.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators,
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

$500 REWARD! LOST OR STOLEN.

NO QUESTIONS ASKED. Scarcely a day passes but what the daily papers contain several advertisements with above heading. Over 100 strangers are robbed and swindled every day. SO DON'T COME TO NEW YORK UNTIL YOU HAVE READ

"HOW COUNTRY PEOPLE ARE SWINDLED IN NEW YORK."

Price only 25 cents, postpaid, or five copies to one address for $1. Frauds and swindlers of all kinds are exposed. Faro banks, lotteries, policy shops, confidence men, blackmailers, pickpockets, panel houses, Wall street sharks, and a thousand and one swindles you never heard of are "shown up." Read following extract of a letter just received from a farmer in New York State: "I had just been paid for my season's butter when I was induced to invest $1,800 in a swindle which you expose in your book, and had I only read it 6 months ago I would now be $1,800 better off." REMEMBER the price is very low, only 25 cents, and it may save you $2,000. Postage stamps taken. Agents wanted in every town. It is selling like hot cakes. Canvassers are coining money. Big discount. Don't delay, but send at once. Address
HENRY S. BARTON & CO., Publishers, 1 & 3 Murray St., New York.

PATENT
COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburg, Pa.
190 S. Canal Street, Chicago, Ill.
☞ Stocks of this shafting in store and for sale by
FULLER, DANA & FITZ, Boston, Mass.
Geo. Place Machinery Agency, 121 Chambers St., N. Y.

IT PAYS to sell our Rubber Hand Printing Stamps. Circulars free. G. A. HARPER & Bro., Cleveland, O.

PATENTEES, NOTICE!

Ebr. Stehman & Co., proprietors of Manheim Foundry and Machine Shops, Manheim, Lancaster Co., Pa., are prepared to contract for, and manufacture to order, any kind of machinery in their line, in quantities at prices lower than any other establishment in the country. Correspondence and orders solicited.

PORTER MANUF'G CO.,

The New Economizer, the only Agricultural Engine with Return Flue Boiler in use. Send for circular to Porter Mfg. Co., Limited, Syracuse, N.Y.
G. G. YOUNG, Gen. Agt., 42 Cortland St., New York.

The Premium Bucket.

DUC'S IMPROVED ELEVATOR BUCKET.

Made in sizes from 3½ to 20 inches. For use in FLOUR, GRAIN, MALT, ORES, COAL, BROKEN STONE, SAND, DRUGS, SPICES, PLASTER, etc., etc. These buckets are struck out from the best charcoal iron, and are almost indestructible. No corners to catch. No seams to burst. Run with great ease and fill full every time. No interior corners to clog up.
T. F. ROWLAND, Sole Manufacturer, Brooklyn, N. Y.

PIANOS $150 TO $400.—All strictly first-class.—Sold at Wholesale factory prices. Highest Honors at Centennial Exhibition. Mathushek's Scale for Square Grands. Finest Uprights in America. 12,000 in use. Catalogue of 48 pages—free. JUBILEE ORGANS, the best in the world. An 8 stop organ only $65; 13 stop, $97—Circular free. All sent on 15 days' trial—freight free if unsatisfactory. Factory, 57th St. and 10th Ave. SHEET MUSIC at 1-3 price. Catalogue of 3,000 choice pieces sent for 3c. stamp. Address
ORGANS
MENDELSSOHN PIANO CO., Box 2058, N. Y.

GRANT & CO., Manufacturers of Cap Rifles, Targets and Gun Implements; also Model and Light Machinery of all varieties to order on reasonable terms.
HEDENBERG WORKS, NEWARK, N. J.

WANTED.—INFORMATION AS TO THE best process of treating June butter, in large quantities, to preserve it sweet and fresh-flavored for winter market. Any valuable information will be satisfactorily rewarded. Address Amateur Butter Dealer, Box 773, N.Y.

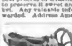
$10,000 INSURANCE FOR 25 Cts.

ON LIFE & PROPERTY. $10,000 will be paid to any person who can explode a lamp fitted with our SAFETY ATTACHMENT. Agents Wanted. Salesroom, 13 West Broadway, N.Y.
S. S. NEWTON'S SAFETY LAMP CO., Binghamton, N. Y.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29 ST. NEW YORK CITY

To Electro-Platers.

BATTERIES, CHEMICALS, AND MATErials, in sets or single, with Books of Instruction for Gold, Silver or Nickel Plating. THOMAS HALL, Manufacturing Electrician, 11 Bromfield Street, Boston, Mass. Illustrated Catalogue sent free.



Forster's Rock & Ore Breaker and Combined Crusher and Pulverizer.

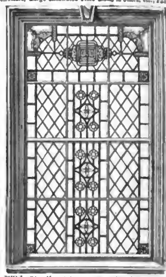
The simplest machine ever devised for the purpose.

Parties who have used it constantly for six years testify that it will do double the work of any other Crusher, with one-third the Power, and one-half the expense for keeping in repair. The smaller sizes can be run with Horse Power.
Address TOTTEN & CO., Pittsburgh, Pa.

Adorn Your Window with the new Patent

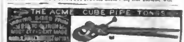
STAINED IMITATION GLASS

NEW, ELEGANT, CHEAP, and DURABLE. Is easily applied, temporarily or permanently, to glass in windows of Churches, Libraries, Vestibules, Doors, Transoms, Bath Rooms, Stairways, etc., with the full effect and brilliancy of variously colored stained glass. Curtains and shades dispensed with. A new, easy, and fascinating occupation for ladies and gentlemen in tastefully beautifying their homes, offices, etc. Samples of two styles, and... mailed with full instructions on receipt of 50 Cents. Circulars, Large Illustrated Price Lists, in Colors, etc., FREE.



AGENTS WANTED! L. LUM SMITH, 729 Sansom St., Phila., Pa.

PERFECT HARNESS with only an OPEN COLLAR and a HOLD BACK. Enclose one of two one-cent stamps and address MINIMIZED HARNESS OFFICE, 311 North 13th St., St. Louis, Mo.



THE ACME CUBE PIPE TONGS

THE CONSTRUCTION OF CANVAS Canoes.—By W. P. Stephens. Complete description and working drawings of two handsome and serviceable boats, designed for the benefit of those who do not care to go to the expense of a wooden canoe and who prefer to build and equip their own craft. The larger boat in model is similar to the famous Rob Roy, but is an improvement upon that. Dimensions: length, 14 ft.; beam, 28 in.; depth at bow 13½ in.; stern, 11 in.; amidship, 9 in.; draught, loaded, 5 in. The smaller boat is well suited for a boy, and will do for hunting, fishing and cruising. It is very portable. Length 12½ ft.; beam 24 in.; depth 12, 11½, and 9½ inches. By means of the detailed directions and drawings here given, anyone with slight mechanical ingenuity, can construct for himself a boat which, with proper care in use, will prove very durable. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. 216. To be had at this office and from all newsdealers.

Leffel Water Wheels,

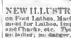
With recent improvements.
Prices Greatly Reduced.
8000 in successful operation.
FINE NEW PAMPHLET FOR 1879,
Sent free to those interested.
James Leffel & Co.,
Springfield, O.
110 Liberty St., N. Y. City.

LOOSE PULLEYS.

Self-lubricating, best in market. Send for circular and price list to W. OESTERLEIN, 31 Home St., Cincinnati, O.

Shafts, Pulleys, Hangers, Etc.

Full assortment in store for immediate delivery.
WM. SELLERS & CO.,
79 Liberty Street, New York.

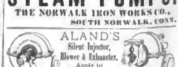


GRISCOM & CO'S VALVE REFITTING MACHINE POTTSVILLE, PA.

NEW ILLUSTRATED CATALOGUE, 1880, on Foot Lathes, Machinists' Tools, Gear Cutting Attachment for Lathes, Improved Work Holder, Twist Drills and Chucks, etc. Small Steam Motor; no boiler; no danger. Suitable for running Light Machinery. Address JACKSON & TYLER, 2 German St., Baltimore, Md.

STEAM PUMPS.

THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.



ALAND'S Silent Injector, Blower & Exhauster.
Apply to S. ALAND, Rome, Oneida Co., N. Y.

FOR SALE. Extra Strong Screw Presses, Calender Rolls, and other machinery connected with the manufacture of ... cards and tickets. This offers an excellent opportunity for any one desirous of a profitable business with unlimited demand. Address GEO. BAILEY, ... Buffalo.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

"BUCKEYE" LAWN MOWER.

The lightest and easiest running Mower ever made.
STRICTLY FIRST CLASS.
MAST, FOOS & CO., Springfield, Ohio.
Send for catalogue.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SONS, Buffalo, N. Y.

H.W.JOHNS' ASBESTOS LIQUID PAINTS

are strictly pure linseed-oil paints of a higher grade than have ever before been manufactured for structural purposes.

A saving of 25 to 33 per cent. of customary outlays can be effected by the use of these paints. Samples of [illegible] newest shades for dwellings sent free by mail.

Be sure and get the genuine, which are manufactured only by

H. W. JOHNS M'F'G CO.,
87 Maiden Lane, New York.
Sole Manufacturers of Genuine ASBESTOS ROOFING, BOILER COVERINGS, &c.
Descriptive Price Lists free by mail.

WATCHMAN'S Improved Time Detector, with Safety Lock Attachment. Patented 1875-6. Beware of infringements. This instrument is supplied with 12 keys for 12 different stations. Invaluable for all concerns employing night watchmen. Send for circulars to E. IMHAUSER, P. O. Box 2875. 212 Broadway, New York.

Gear Molding without Patterns

Scott's Gear Moulding Machines,

AIR COMPRESSORS & ROCK DRILLS.

DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
FOOT OF W. 13th ST., North River, NEW YORK.
ESTABLISHED 1841.

J. STEVENS & CO.,
P. O. Box 28, Chicopee Falls, Mass. Manufacturers of Stevens' Patent Breech-Loading Sporting and Hunters' Pet Rifles, Single and Double Barrel Shot Guns, Pocket Rifles, Pocket Shot Guns, Gallery Rifles, Superior Spring Calipers and Dividers including the New Patent Coil Spring Calipers; also Double Lip Countersinks and Hathaways' Patent Combination Gauge.

THE PICTET ARTIFICIAL ICE COMPANY, Limited.
Ice Machines to make from 20 pounds per hour to 50 tons per day, at 36 Cortlandt St., New York. P. O. Box 288.

BI-SULPHIDE OF CARBON. E. R. TAYLOR, Cleveland, O.

THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

FRIEDMANN'S PATENT INJECTOR,
The best
BOILER FEEDER
In the world.
Simple, Reliable, and Effective.
40,000 IN ACTUAL USE.
NATHAN & DREYFUS,
Sole Manufacturers, *NEW YORK.*
Send for Descriptive Catalogue.

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers and Builders is called to the great decline in prices of wrought STRUCTURAL IRON.
It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders, on application.

THE MACKINNON PEN OR FLUID PENCIL.

Particulars mailed Free.
MACKINNON PEN CO.,
200 Broadway, near Fulton St., N.Y.

The New York Ice Machine Company,

21 COURTLANDT STREET. ROOM 54.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more Ice. Uses only ¼ water of condensation. No Pressure at rest. Pressure in running, 14 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

COLUMBIA BICYCLE.
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of *The Bicycling World*.
THE POPE M'F'G CO.,
89 Summer Street, Boston, Mass.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.

INVALID ROLLING CHAIR.

(RECLINING)

A Priceless boon to those who are unable to walk. Hon. A. H. Stephens, M. C., and hundreds of others use them. Send for Circular to
FOLDING CHAIR CO., New Haven, Conn.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS.—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

WOOD SOLE SHOES.
The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send stamp for circular and price list.
CHAS. W. COPELAND, 122 Summer St., Boston, Mass.

BUY NO BOOTS OR SHOES
Unless the soles are protected by Goodrich's Hammer Sled Rivets. Guaranteed to outwear any other sole. All dealers sell them. [illegible] mail for 25 cents in stamps. Send paper pattern [illegible] wanted. H. C. GOODRICH, 19 Church St., W[illegible], Mass.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

THE WATSON PUMP FOR ARTESIAN OR DEEP WELLS ... PUMPING PISTON ROD, PLUNGER & VALVE ... IN DIRECT LINE ... MACHINE SIMPLE EFFICIENT ... JAMES WATSON ... N. FRONT ST. PHILA.

BOILER COVERINGS.

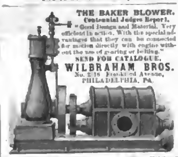
Plastic Cement and Hair Felt, with or without the Patent **"AIR SPACE"** Method.
ASBESTOS MATERIALS,
Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John Street, and Foot of E. 9th Street, New York.

ILLUSTRATIONS OF ALL KINDS MADE QUICKLY AND CHEAPLY.

ILLUSTRATED CIRCULAR SENT ON RECEIPT OF STAMP.

HARDWOOD LUMBER AND VENEERS.

Mahogany, Rosewood, Satinwood, French and American Walnut, Burl Veneers, Hungarian Ash, Amaranth, etc., etc. Manufacturers will find our stock unusually choice and prices low. Full line of Rare and Fancy Woods planed for Amateur's use.
GEO. W. READ & CO.,
186 to 200 Lewis St., New York.



THE BAKER BLOWER.
Centennial Judges Report.
"Good Design and Material. Very efficient in action. With the special advantages that they can be connected for motion directly with engine without the use of gearing or belting."
SEND FOR CATALOGUE.
WILBRAHAM BROS.
No. 2318 Frankford Avenue, PHILADELPHIA, PA.

GENUINE BABBITT METAL,

Fine Brass and Composition Castings.
E. STEBBINS M'F'G CO., SPRINGFIELD, MASS.

MICROSCOPES, OPERA GLASSES, SPY Glasses, Spectacles, Thermometers, Barometers, Compasses. R. & J. BECK, Manufacturing Opticians, Philadelphia, Pa. Send for ILLUSTRATED PRICED CATALOGUE.

Holly's Improved Water Works.

Direct Pumping Plan. Combines, with other advantages, over older systems, the following: 1. Secures by variable pressure a more reliable water supply for all purposes. 2. Less cost for construction. 3. Less cost for maintenance. 4. Less cost for daily supply for all use of Holly's Improved Pumping Machinery. 5. Affords the best fire protection in the world. 6. Largely reduces insurance risks and premiums. 7. Dispenses with fire engines in whole or in part. 8. Reduces fire department expenses. For information by descriptive pamphlet, or otherwise, address the
HOLLY MANUFACTURING CO., Lockport, N. Y.

AHEAD OF ALL COMPETITION! 1880.

EIGHT SIZES FOR HAND USE.
Weighing from 22 to 51 lbs.
THREE SIZES FOR HORSE POWER.
The very large increase in our sales last year prove that these machines fully sustain the awards "AS THE BEST" made to them at the great Centennial "hundred day trial," in Philadelphia, in 1876, and their complete victory at the Paris Exposition in 1878. We offer for 1880, Machines from entirely new patterns and greatly improved in every respect.
Examine our New Lawn Sweepers. Hand or Horse size.
GRAHAM, EMLEN & PASSMORE, Patentees and Manufacturers, 631 Market St., Philadelphia, Pa.
Send for Descriptive Catalogue with prices.

PATENT Galvanized Iron Tackle Blocks
For all Hoisting Purposes. Light, Easy Running, Durable. Superior to all Wood Blocks. Cheaper than all other Iron Blocks.
PROVIDENCE TOOL CO., Providence, R. I.

A NEW TREATMENT for Consumption, Asthma, Bronchitis, Catarrh, Dyspepsia, Headache, Debility, Neuralgia, Rheumatism, and all Chronic and Nervous Disorders.
ACTS DIRECTLY upon the great nervous and organic centres, and cures by a natural process of revitalization.
HAS EFFECTED REMARKABLE CURES, which are attracting wide attention.
HAS BEEN USED BY Rt. Rev. John J. Keane, Bishop of Richmond, Va., Hon. Wm. D. Kelley, T. S. Arthur, and others, who have been largely benefited, and to whom we refer by permission.
IS STRONGLY ENDORSED: "We have the most unequivocal testimony to its curative power from many persons of high character and intelligence."—*Lutheran Observer.* "The cures which have been obtained by this new treatment seem more like miracles than cases of natural healing."—*Arthur's Home Magazine.* "There is no doubt as to the genuineness and positive results of this treatment."—*Boston Journal of Commerce.*
THE OXYGEN HOME TREATMENT contains two months' supply, with inhaling apparatus and full directions for use.
SENT FREE: a Treatise on Compound Oxygen, giving the history of this new discovery and a large record of most remarkable cures. Write for it. Address
Drs. STARKEY & PALEN, 1109 and 1111 Girard St., Philadelphia, Pa.
ADMINISTERED BY INHALATION.

THE TANITE CO., STROUDSBURG, PA.

EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES AND AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL Co
SEND FOR PAMPHLET FITCHBURG MASS.

ORGAN BEATTY PIANO
New Organs 13 Stops, 3 set Golden Tongue Reeds, 5 Oct's, 2 Knee Swells, Walnut Case, warnt'd 6 years, Stool & Book $98. New Pianos, $143 to $255. Newspaper sent Free. Address Daniel F. Beatty, Washington, New Jersey.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

PORTLAND CEMENT,

From the best London Manufacturers.
K. B. & S. AND BURHAM CEMENTS.
For sale by JAMES BRAND, 85 Beekman St., New York.

FOOT PRESSES.
STILES & PARKER PRESS CO., Middletown, Conn.

The Rodier Patent Single Iron Plane.

Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAMSON MANUFACTURING CO., North Elm Street, Westfield, Mass.

The Asbestos Packing Co.,

Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:

PATENTED	ASBESTOS	ROPE PACKING,
"	"	LOOSE "
"	"	JOURNAL "
"	"	WICK "
"	"	MILL BOARD,
"	"	SHEATHING PAPER,
"	"	FLOORING FELT,
"	"	CLOTH.

BROWN'S PAT. SPLIT PULLEYS Shafts, Hangers
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

PROSPECTUS OF THE Scientific American FOR 1880.

The Most Popular Scientific Paper in the World.

VOLUME XLII. NEW SERIES.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 20. [NEW SERIES.] | NEW YORK, MAY 15, 1880. | [$3.20 per Annum. [POSTAGE PREPAID.]

AMERICAN INDUSTRIES.—No. 42.

A SHIRT AND COLLAR FACTORY.

That a business of this kind could ever grow into a really important and considerable branch of American factory industry would never have been thought possible by our grandfathers. In fact, most men of middle age can remember when they shook their heads at the idea of buying ready made shirts and collars, for the making of these necessary garments seemed an indispensable part of the duty of all exemplary wives and daughters, and any young woman who had not proved her capabilities in this direction was supposed to have had a faulty "bringing up." The advent of ready-made clothing and ready-made boots and shoes, however, was soon followed by that of ready-made shirts, collars, and cuffs, the manufacture of which, in a wholesale way, has been for some years a business of considerable consequence.

In the illustrations which are presented below are seen the principal departments in a representative factory of this description—that of Geo. P. Ide, Bruce & Co., Troy, N.Y. In a business of this kind, where all the details of the work are such as almost every one is more or less conversant with, it necessarily follows that success is possible only by giving the closest attention to every item, so that, in the division of labor, in the cutting of stock, in the oversight of the great number of hands employed, both in and out of the factory—in a number of things that seem little in themselves—there be no room for waste, and the whole work shall move like one great machine, and always with the greatest possible economy. It is only in such a way that sufficient margin of profit can be figured out to support a business of this nature, where each individual customer could with little difficulty supply himself with the articles made, and would do so if the factory system did not produce them a little cheaper as well as better than the average of home-made goods. How this firm have succeeded in this line is best evidenced by the steady growth of their business and the great dimensions it has attained, their product for one year having exceeded that of one of the largest and oldest iron foundries in Troy. Their regular manufacture, during the busy season, amounts to 200 dozen shirts and 2,000 dozen collars per day, and so complete are the facilities of the establishment, so ample are their arrangements for obtaining the large number of hands wanted, that even this great production could be exceeded if the wants of the trade should seem to call for such enlargement.

In the cutting department, as shown in the view on the right hand at the bottom of the page, there is room for spreading 6,000 yards of cloth at a time on the long tables. This work is all done by men, who use a knife particularly adapted for the purpose, known as the shirt-cutters' knife. Wood patterns are used, and 48 thicknesses of cloth are cut through at one time. Dies cannot be economically used for this purpose, as the springing of the cloth would cause more waste. Irish linen is principally used for the collars and cuffs, and the rags from this sell at the same price as those from the white muslin for the shirts, about twenty-five tons a year being made, which are sold to the paper manufacturers for making the finest ledger paper. Both white and colored shirts, of many different styles, are made; but in the latter class it is intended to keep the production close down to the actual immediate wants of the trade, as white goods only are staple, and sure to be in demand all the time. As many as eighteen different patterns are sometimes required for one size of shirts. The collar cutting includes

[*Continued on page 309.*]

MANUFACTURE OF SHIRTS AND COLLARS.—GEO. P. IDE, BRUCE & CO., TROY, N. Y.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, MAY 15, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 228.

For the Week ending May 15, 1880.

Price 10 cents. For sale by all newsdealers.

THE USE OF STEEL FOR STRUCTURAL PURPOSES.

At the last meeting, in Pittsburg, of the Engineers' Society of Western Pennsylvania, the subject which most interested the iron and steel men of Pittsburg was the topic ably handled by Mr. A. F. Hill, C.E., of New York, in his paper entitled "Steel in Construction." The points presented embodied a series of interesting tests conducted by the gentleman named, with open hearth Pittsburg steel from the establishment now supplying the steel for the wire used in the East River Bridge cables. These experiments were conducted at the works of the Keystone Bridge Company, Pittsburg, at J. M. & J. B. Cornell's works, New York, and at the United States testing machine at Watertown, N. Y. Following are the salient points in Mr. Hill's paper:

"Within the past few years there has been developed in this country a tendency toward steel construction, which today is so pronounced as to command the most thoughtful consideration alike of constructors and manufacturers. The adaptability of steel to purposes of construction is probably no longer questioned, yet there is still a certain distrust of the material in minds of many thoughtful men, who believe steel to be endowed, more than any other material, with that exasperating quality which might fitly be called the 'innate cussedness' of inanimate objects. This arises undoubtedly from some of the remarkable and seemingly inexplicable failures which have occurred in finished parts of steel, some of them breaking under loads utterly inadequate to produce rupture, others breaking in some instances without any apparent cause at all. I use the expression 'seemingly inexplicable' advisedly, for I believe that every such extraordinary failure is susceptible of rational explanation, and can almost invariably be traced, not to the inherent defect in the material itself, but to the wrong treatment of the steel during the process of manufacture into parts of the structure. I propose to lay before you the results of some steel tests made under such conditions as would naturally arise when the material is to be used in a structure."

The samples tested ranged from 0·20 per cent to 0·50 per cent carbon, and were in the form of eye bars, plates, and girders. In the first named, the eye bars were from the Kloman machine, which rolls the bar complete from end to end; the Keystone "upset" bar, and bars made by welding and die forging. The tests showed that the first two classes gave best results, and the last named second best, and the process of welding and die forging "could not be recommended for general practice." The tensile strength of these bars ranged from 93,000 lb. per square inch in the 0·30 per cent and 102,000 lb. in the 0·50 per cent steel.

The tests made on plate steel were crucial. A ¾ steel plate was tested in the direction of rolling, and across the same; also as to the relative strength of sheared and punched plates, and the effects of annealing and tempering. To ascertain just what such a plate, would stand, Mr. Hill punched out the edges of such a plate and then reduced its gauge by cold hammering to $\frac{1}{16}$ of an inch. The sample was then heated to a bright cherry, and annealed forty-eight hours in lime. A test showed an elastic limit of 53,000 lb., and an ultimate strength of 100,400 lb. In tempering sheared and punched plates from a low heat in oil, the effect was contrary to what might be expected; instead of rendering the material hard and brittle, it restored its ductility and increased its ultimate strength. The last test was with a steel girder of $\frac{5}{16}$ web plate, 12 inches high, with $\frac{5}{16}$ top and bottom plate, and $\frac{5}{16}$ $2\frac{1}{2}$ x $2\frac{1}{2}$ steel angle. For such a girder (6 feet long) in iron the test load would have been not quite 22 tons distributed load. The steel girder was tested up to 65 tons distributed safe load; and under a continued application of 100 tons distributed load, acquired only a permanent set of half an inch.

Mr. Hill concluded his paper as follows: "The foregoing tests are a fair indication of the wide range of application steel is capable of in construction, and they also show very conclusively that our present methods of dimensioning will have to undergo modification; that our present safety factors, based as they are entirely upon an assumed ultimate strength, become almost meaningless when we have to proportion in steel; and last but not least, that our mechanics must learn to test steel as steel, and not as iron. Steel construction is undoubtedly *the* construction of the near future. The conservative element in our profession which to-day opposes it will still oppose it twenty years hence, just as it took them twenty years to learn that iron was better than wood. This conservative element is not without its use by any means; nor are the sand bags to the aerial navigator; they help to steady the flight of his air ship at the lower levels. To make the comparison complete, let me add, that to reach a higher altitude, they must both be thrown overboard."

TWO TONS OF SILVER PER WEEK.

There are five establishments in the United States where the smelting and refining of silver-bearing lead ores is carried on. One of the most extensive, if not the most extensive, of these works is that of the Pennsylvania Lead Company, of Pittsburg, Pa. Here the "base bullion" of Leadville and of Utah is brought to meet the cheap coke and coal of Pennsylvania, and though the freight per car averages $300, the business has grown to great proportions. President Schwartz, of the above company, gives figures showing that 60 per cent of the "base bullion" output of Leadville is shipped to the Pittsburg refining works, besides 75 per cent of the output of Utah lead mines. "Base bullion" is the product of the ore smelters of the mining regions, and bears about the same relation to refined silver as pig metal to refined steel. At the Pittsburg refining establishment this base bullion is converted into lead, silver, and gold. The precious metals find their way to New York, while the lead is consumed by the makers of white lead. The Utah ores are the richest in gold, sometimes reaching 40 ounces per ton. Of silver, the Pennsylvania Lead Company ships 50,000 ounces per week, or two tons, representing in value, at $1.14 per ounce, $57,000. This metal leaves the works in pretty bars of 2,000 ounces each.

THE TELEGRAPH SET SCREW.

The decision of Judge Blatchford sustaining the Page Electrical Patent was noted in our issue of March 6.

April 4 Judge Blatchford heard motions by the American Union Telegraph Company, the Wabash, St. Louis and Pacific Railway Company, and the Union Pacific Railway Company, praying to have the decision referred to so modified as to exempt them from the payment of royalty to the Western Union Telegraph Company, on the grounds that they have always used the machine and devices invented and patented by Prof. Morse, and that it could be proved that the original Morse instrument on exhibition in the office of the Western Union Telegraph Company was made by Prof. Morse as early as 1835, and contained all the essential parts of the apparatus and devices set forth in the eleventh, twelfth, and thirteenth claims of the Page patent.

The petitioners allege further that the defense in the previous suit could have proved (though they did not) that the testimony of Page in the suit of French against Rogers related to these essential parts of the Morse apparatus and devices; they could have proved by Thomas Hall of Boston that in 1847 he manufactured a machine under the Morse patent, which contained a device and combination adjusting or regulating the length of the vibration at the armature of an electro-magnet by means of a set screw as described in the 13th claim of the Page patent; they could have produced an affidavit of Mr. Page himself, taken in 1848, in the suit of Morse against O'Reilly; also, the defendants could have proved by the Rev. S. Irenæus Prime that Mr. Page wrote to the Hon. Amos Kendall in 1848 that he had never claimed the invention of the receiving magnet used in the Morse telegraph; and the defendants could have made use of the depositions of Professor Morse, taken in 1850, in the suit of French against Rogers, and of Leonard D. Gale in the suit of Morse against O'Reilly.

The petitioners further asserted that they were ready to produce before the court one of the machines now and for many years past used by them in telegraphing, and the machines used by Mr. Hall, and if aided by the process of the court they will cause to be produced by the Western Union Company the machine used by Prof. Morse and presented to the company after his death; upon a comparison of which it would be seen that the machines now used by the petitioners and that made by Mr. Hall and that used by Prof. Morse are alike in their essential parts, and that all of them have the designs and appliances mentioned in the eleventh, twelfth, and thirteenth claims of the Page reissued patent.

Two weeks were allowed by Judge Blatchford for the plaintiffs to make answer. When the case was called the counsel for the Western Union Telegraph Company denied that due diligence had not been used in obtaining evidence in the previous trial, and produced the original model of the Morse telegraph instrument, to show that the disputed set screw governing the play of the armature was not there and never had been. It was held by the opposite side that the original screw had been removed and another substituted, whereat an excited colloquy ensued between the opposing counsel; but no evidence would appear to have been brought to show the real function of the screw which the model now carries.

The arguments of the counsel being unfinished for lack of time, the case was carried over to Monday April 26, and again to April 30.

STEAM INJECTORS.

Among the most reliable and effective devices in this class the Rue's Little Giant Injector occupies a prominent place. It is made by the Rue Manufacturing Company, Philadelphia, Pa. The lawsuit for infringement, recently mentioned in our paper, has, we learn, been fully settled, and the company is now increasing its facilities and extending its sales. The Rue Company's advertisement will be found in another column.

THE REGISTRATION OF TRADE MARKS.

A bill to provide for the registration and protection of trade marks was passed by the House of Representatives, April 27. It included the first thirteen sections of Bill No. 5088, submitted by the Committee of the Judiciary as a substitute for H. R. 2573, and H. Res. 125.

The committee sought to re-enact substantially the trade mark legislation of 1870 (Rev. Stat., sections 4937–4947 inclusive) with the act of 1876, save that the operations of the proposed law were confined to trade marks used in commerce with the Indian tribes and foreign nations.

Before its passage the House struck out all the penal and search-warrant clauses (sections 14 to 21 inclusive); so that the proposed law re-enacts only so much of the old trade mark laws as are embraced in sections 4937–4943 of the Revised Statutes.

The bill as passed also provides that applicants for regis-

tration under it shall be credited for any fee, or part of a fee, heretofore paid by them into the Treasury of the United States with the intent to procure protection for the same trade mark, and that citizens wishing to register trade marks in foreign countries, where prior registration here is a condition precedent to registration there, may register here for such purpose.

RECENT TELEPHONE EXPERIMENTS.

At the suggestion of one of the proprietors of this journal —Mr. A. E. Beach—a series of interesting experiments relating to the electrical transmission of sound has lately been commenced in this vicinity, which seems likely to lead to a variety of useful results. In the introductory experiment the SCIENTIFIC AMERICAN office and Mr. Beach's dwelling, in the upper part of this city, were connected by wire with the auditorium of Plymouth Church—Rev. Henry Ward Beecher's—in Brooklyn, N. Y., and these points were also telegraphically joined by the wires of the Bell Telephone Company and those of the Gold and Stock Company, the electrical circuit being thus enlarged and ramified in all directions, communicating with offices and dwellings in New York, Brooklyn, Jersey City, Newark, Orange, Elizabeth, Yonkers, and other adjacent places. One object of the experiment was to determine approximately through how many united circuits and lines the voice of a public speaker might be simultaneously transmitted.

At Plymouth Church, in Brooklyn, the wire passed under the floor to the platform or pulpit, where it connected with two of the well known Blake transmitters, arranged upon a shelf under the speaker's desk. The general arrangements for the experiments were under the charge of Mr. Frederick C. Beach, Ph.B., of the SCIENTIFIC AMERICAN office.

When it became known at the Bell telephone office in Brooklyn that experiments were to be tried, the interesting news soon spread to all of the other telephone offices, and the various operators not only called into their offices parties of their friends to enjoy the treat, but gave notice to numbers of private persons having communicating wires, who in turn invited friends to their dwellings. Thus at many points on the great ramification of connecting wires were groups of persons waiting, with telephones at their ears, to hear the words of the distinguished speaker. At one of the stations fifteen telephones were in this way connected, the instruments being joined by wires, just as a circle of people join hands in sharing an electrical shock.

The first experiment was made on Sunday, April 18, and was on the whole perhaps more successful than could have been expected. The telephone listeners stationed in Brooklyn, and nearest the church, were enabled to hear the service with much satisfaction; but those in New York, Yonkers, and Orange, N. J., only heard the music and portions of Mr. Beecher's sermon. It was concluded on the whole that there were too many telephones in circuit; and it was subsequently ascertained that the wire leading to the church had been surreptitiously tapped where it passed over a dwelling, a ground made on the tin roof, and a considerable number of telephones smuggled in.

On the following Sunday, April 25, another trial was had, precautions having been taken not to allow so many tapping lines or instruments in circuit. Special care was also taken by Mr. Adee, the adjuster of the Bell Telephone Company, to give the most delicate adjustment to the transmitting instruments at the church. The result was most successful and marvelous.

From the opening note of the organ prelude to the last word of the preacher's voice, at the close of the service, everything was delivered to the ears of the listening telephoners in the most perfect manner, the tones that came over the wires being so full, round, clear, and distinct, it almost seemed to the hearers in New York, Yonkers, and Elizabeth as if they were stationed within the church itself directly in front of the speaker.

The delivery of the music was equally perfect, every note of the organ and of the individuals of the choir being fully brought out. The majority of the participators in this experiment were persons accustomed to the use of the telephone, and their unanimous verdict was that the results obtained far surpassed anything of the kind within their previous experience.

In consequence of the successful progress of these experiments, several new improvements have been suggested for trial, and there seems to be every probability that in a short time some new and very effective instruments will be in use, by which all who desire may carry the sounds of church services into their dwellings, and may also enjoy the best lectures, musical and other entertainments with the utmost satisfaction in their homes. Heretofore, in listening to the telephone, it has required effort and strain of the ear on the part of the listener. But this experiment shows that all sounds may be delivered in full and easy tones, readily heard, with all the natural characteristics, modulations, and inflexions of the human voice.

We shall keep our readers informed of the further results accruing from this series of experiments. With the continued co-operation of the various electricians and managers of the lines it is believed that something of value to science may be adduced.

The progress and success of the experiments up to the present time have been greatly promoted by the active interest taken and assistance rendered by the gentlemen connected with the several telephone companies, to all of whom we return our sincere thanks. We are under especial obligations to Mr. C. F. Wiley, Superintendent of the Gold and Stock Company; to Mr. H. R. Butler, Secretary of the company; to Mr. T. G. Ellsworth, Electrical Manager of the company, through whom the experimental circuits were in the first instance arranged; to Mr. Henry W. Pope, Superintendent of the Bell Telephone Company; to Mr. E. T. Greenfield, Assistant Superintendent; to Mr. C. N. Chinnock, Electrician of the company; to Mr. D. M. Adee, Adjuster of the company; to Mr Robert Brown, Superintendent of Construction; Mr. Grinsted, of the Orange office; Mr. Alfred Hanford, manager of the Brooklyn office; Mr. Charles Walton, manager of the Nassau-street office, N. Y. Mr. R.W. Macgowan; also to Col. Wm. H. Paine, C. E., and to C.C. Martin, C. E., Assistant Engineer of the great Suspension Bridge between New York and Brooklyn, for permission to lay a temporary experimental wire across the foot bridge.

THE COFFEE PRODUCT.

From an exhaustive review of the coffee trade of all countries by the managers of the Java Bank (Batavia), it appears the total crop of the world for 1855 was 330,165,000 kilos; for 1865, 421,950,000 kilos, and that the average of the three years 1876-7-8 was 490,840,000 kilos. The figures represent an increased consumption of 27 per cent over fifteen years ago, and of 47½ per cent over 1855. In the Dutch Indies the increase since 1855 has been below the average rate in other countries. In the British Indies and Ceylon the crop has nearly doubled. The total for Asiatic countries is in about the average ratio for the whole world. Brazil falls somewhat below the average ratio of progress; and the same is true of the West Indies; while the most notable increase is in the case of Central America, where the crop has risen from 3,500,000 kilos in 1855 to 32,500,000 in 1876-8. In the South American countries other than Brazil the production has risen from 22,300,000 kilos to 35,900,000, which also is above the average ratio.

It may not be generally known that Guatemala produces some of the best coffee that is grown in any country; but such is the fact. From the plantation of Mr. José Guardiola, of Chocola, there has been sent to New York, the past year, a grade of coffee surpassing in quality either Java or the celebrated Mocha. The kernel of the Guatemala coffee is small and plump, resembling the best quality of wheat and but little larger.

Mr. Guardiola has introduced drying machines of his own invention, which enables him to cure his coffee in wet as well as sunny weather, and he has also patented in this and other countries a hulling and polishing machine, which he uses with great success on his extensive plantation. To the introduction of these machines is no doubt attributable the preservation of the delicious flavor and aroma of Guatemala coffee. Coffee growers in other countries will do well to introduce Mr. Guardiola's machines on their plantations.

IMPROVED TELEPHONE CENTRAL OFFICE SWITCH BOARD.

On page 15 of the current volume of this journal we illustrated and described one of the largest telephone central offices in this city, and alluded briefly to an improved switch board invented by Mr. T. G. Ellsworth, manager of the office. This switch board has been in use for a number of months, saving a great deal of labor and greatly facilitating the business of the office. A patent has just been issued to Mr. Ellsworth for this improvement. The invention consists in a board provided with a number of longitudinal bars used to connect the wires of the different subscribers. When these bars are in use they are turned to indicate that they are occupied, so that the switchman may know at a glance which rods are unoccupied.

This switch board has proved its utility by long use, and is especially adapted to small exchanges, and may be easily and cheaply applied.

Wind Pressure.

At a recent meeting of the Scottish Meteorological Society, Mr. St. John Vincent Day, C.E., spoke upon the great importance to engineers and bridge builders of having accurate records of the velocity of the wind. Having seen remarks in the newspapers that the Forth Bridge had been passed by the railway authorities and the Board of Trade, he had made inquiries respecting the calculations on which it had been based, and he had found, on the authority of the Astronomer Royal, that only 10 lb. per square foot had been allowed for wind pressure. Engineers had considered the matter, and he believed they had reported that with regard to wind pressures they had found nothing upon which they could place any dependence, except the old tables of Smeaton, which put down the pressure of the wind at from 7 lb to 12 lb. and 13 lb. to the square foot. Numerous wind pressures, Mr. Day showed, had been recorded since then by Professor Rankine, Professor Piazzi Smith, and Dr. Robinson, Armagh, the last mentioned of whom had stated that the gusts of one particular storm, which was half a mile in breadth, blew at the rate of 125 miles an hour for six minutes continuously. What would become of the Forth Bridge in such a gale as that? But of course the bridge as at present devised was not going on. He had that from the Board of Trade. The report of the engineers had been set aside, and the strains as yet were still unsettled. As to the pressure on the Tay Bridge on the night when it fell, the wind would, of course, blow with much greater force down the conical valley of the Tay than it would in the open; and, according to Dr. Robinson, nearly one-third would have to be added to its velocity near the bridge, owing to the contraction there of the Firth. Dr. Robinson had also said he had no doubt that the vertical effect of the wind resisted by the water below and by the pressure of the head above would tend to lift up the whole bridge off the piers. On February 20, 1877, a storm was recorded at Holyhead, the gusts of which blew at the rate of 200 miles per hour; and on November 16, of the same year, there was a storm which blew at 180 miles an hour.—*The Architect.*

The First American Iron Works.

In 1652 James and Henry Leonard established the first bloomery in America, at Taunton, Massachusetts. A correspondent of the *Evening Post* says that the Leonard establishment was about two and a half miles from Taunton Center, now Raynham. Henry Leonard, a brother of James, leaving the latter and his son to carry on the business in Taunton, went to New Jersey, and established a bloomery there. He removed to that State because the ore was much more profitable in its yield, and purer.

When the British Parliament prohibited the manufacture of iron in the colony, in 1750, there were three bloomeries at Taunton, carried on by the Leonards, Deans, Kings, and Halls, all akin by intermarriages. They dug their ore in the neighborhood, all along the streams which empty into Taunton River, mostly, however, along "Canoe River," now "Mill River," and also in the bogs of "Two Mile River." It is proper to add that the Parliamentary prohibition did not stop the work.

The first furnace for making pig iron, according to a recent letter to the Philadelphia *Press* from Principio Furnace, Maryland, was set up at that place in 1715, and its account books are preserved dating as far back as 1725. In 1727 the record shows the price of iron to have been £10 a ton. The writer says that it is probable that the first pig-iron ever exported from America to England—a small lot of three and one-half tons in the year 1718—was made at Principio. Prior to the Revolution Maryland and Virginia made and exported more iron than any other of the colonies. In the custom house returns in England the two colonies are always coupled together, because the Maryland iron was first sent to Virginia in small boats to be reshipped to England, and it is therefore impossible to allot to each colony its proper share of iron exported under the fostering care of the proprietary government. The production of iron increased in Maryland until 1751; it, with Virginia, exported to England 2,950 tons of pig-iron against 199 tons from Pennsylvania, 38 tons from New York, 9 tons from New England, and 17 tons from Carolina.

In 1761 the eight furnaces and ten forges in Maryland made 2,500 tons of pigs and 600 tons of bar iron, while the annual production of England herself at that period was only 17,000 tons of pig-iron. Some of the ore banks worked by the Principio Company were on the Patapsco River, below the site of the future Baltimore, and were first discovered by that wonderful man, Captain John Smith, in 1608. Augustine and Lawrence, the father and brother of George Washington, were among those who had an interest in the Principio Company, which was retained by the Washington family until after the close of the Revolution.

The Use of Atropine in Cataract.

At a recent meeting of the Société de Biologie in Paris (*L'Union Medicale*, January 17, 1880), M. Javal said that atropine might be useful at the outset of cataract before the necessity for operation was indicated. If it were employed, note must be taken of two conditions. If the opacities be central and well limited, the dilatation of the pupil allowing the entrance of a large amount of light into the eye will produce a marked improvement of vision. As regards the state of the refractive power of the media, atropine, besides dilating the pupil, brings on paralysis of accommodation. The patient will not benefit by the first of these effects, unless the inconveniences of the latter be compensated by the help of correcting glasses, which should be most carefully chosen. By combining the use of these two expedients—atropine and spectacles—a large proportion of the visual difficulties depending on cataract may be diminished.

Artesian Well in Boston.

At present an artesian well is being bored in Boston under the direction of Mr. J. A. Whipple, in order to determine whether or not there is under the city an adequate, available supply of pure water. The experience of the men engaged has been as follows: They first bored through six feet of hard filling; then met with a stratum of some soft black substance in a semi-fluid state, about forty to forty five feet in thickness. Below this they found from ninety-three to ninety seven feet of stiff blue clay, overlying a stratum of coarse gravel, in which they found a small stream of excellent pure water. After this they again encountered a twenty foot vein of the stiff blue clay mentioned before, having passed through which they struck a solid bed of hard slate rock or shale, which necessitated the use of the rock drill, which they are using up to the present time. At the depth of three hundred feet they struck a second small stream of good water in the slate rock. They have now reached a depth of about three hundred and seventy-five feet. The tubing they put down measures eight and one half inches, outside diameter, and is one-fourth of an inch thick. The weight now operating on the rock is about 3,000 pounds, the drill itself weighing about 1,600 pounds.

IMPROVED GANG PLOW.

The annexed engraving represents a novel gang plow recently patented by Mr. Francis Stanley, of Toronto, Canada, and possessing many improved features, which render it very effective.

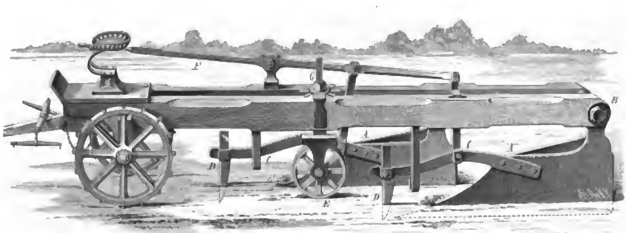
This plow may be readily adjusted so as to cut furrows of different depths, and the plowshares may be raised clear of the ground without detaching any part of the implement.

Two or more plowshares, A, are pivoted to the main frame, as at B, and are provided with arms, C, projecting forward and carrying colters, D. The arms, C, are connected by rods with the lever, F, fulcrumed on the top of the plow frame, and extending to the driver's seat. By means of this lever the plowshares may be easily raised or lowered by the driver without moving from his seat. The forward end of the plow frame is supported by two wheels turning on an axle secured to the frame. The middle of the frame is supported by an adjusting wheel, E, that has a threaded spindle, G, provided with an adjusting nut, by which the distance of the wheel from the main frame may be varied and the shares be consequently raised or lowered. If it is desired to use the plow as a light cultivator, the wheel, E, is removed, and a wheel of peculiar construction is inserted in its place.

The nut on the spindle, G, is then turned so as to raise the plowshares clear of the ground, when the barbed wheel inserted in place of the wheel, E, will act as an efficient cultivator.

The advantages possessed by the plow will be apparent to those familiar with the performance of this class of agricultural implements.

Further information may be obtained by addressing the inventor, Mr. Francis Stanley, care of J. Thompson, 364 Yonge St., Toronto, Canada.



STANLEY'S GANG PLOW.

NEW DUMP CAR.

We present herewith engravings of an improved dumping car patented by Mr. Matthew Van Wormer, of Dayton, O., and now being introduced by the New England Car Company, of 48 Congress street, Boston, Mass. This car possesses many points of novelty which are covered by separate patents. It has been improved from time to time until, as it now stands, it appears to fulfill all the requirements. In its construction it is as simple as well can be when all of its functions are considered. It is a full sized gondola car, and capable of running with the same steadiness and security as the ordinary cars of the same size, while at the same time it is as perfectly manageable as a common dumping wagon.

Fig. 1 shows the entire car in perspective while being dumped; Fig. 2 is a vertical transverse section, taken just in front of one of the trucks; and Fig. 3 is an inverted plan view, showing the apparatus for moving the side bearings.

The car body, A, when in its normal position, is supported by ball and socket rockers, B, in the center, and by movable side bearings, C, on opposite sides of the rockers. The movable side bearings, C, are movable lengthwise of the car, and are connected in pairs with the rock shafts, D, so that the simultaneous movement of the two members of the pair on one side of the rockers is effected by the rocking of the shaft. This operation removes the side bearings of one side of the car and puts it in condition to be dumped. Upon the outer end of the rock shaft there is a lever, E, which is connected with the lever, F, at the side of the car near its end. The lever, E, is connected with a bar, G, extending along the side of the car, and pivoted to four or more lever catches, H, which hold the side doors of the car in position to retain the load. By this arrangement of the levers and their connections the car doors may be released and the supports, B, moved, making the car ready to dump. The apparatus for dumping the car is very simple and effective, and capable of holding the car platform at any desired angle. It consists of a long shaft, I, extending along the body of the car, and provided at one end with a worm wheel, which is engaged by a worm on a vertical shaft, extending upward through the platform of the car, and provided with a lever or wheel by which it may be turned.

Upon drums carried by the shaft, I, are two drums, upon each of which are wound two chains, J K. The chain, J, runs downward around a sheave on the truck timber, thence upward over a sheave on the car body, then downward to

Fig. 1

Fig. 2

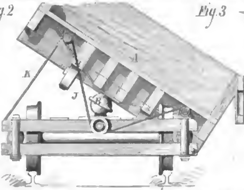
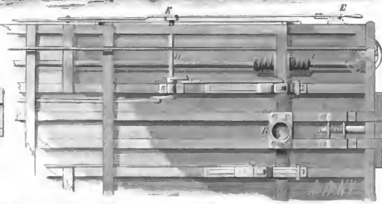


Fig. 3



THE NEW ENGLAND CAR COMPANY'S DUMP CAR.

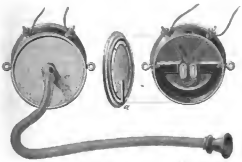
the end of the truck timber, where it is secured. The chain, K, runs directly down to the truck timber. By turning the shaft, I, in one direction the car is dumped on one side of the track, and by turning it in the other direction the load is discharged on the opposite side of the track. This result is secured by winding one of the chains, I J, while the other is unwound. The worm gear affords ample leverage for operating the shaft, I, so that the car may be dumped by one man standing on the platform.

The merits of this dumping car will be understood and appreciated by railroad engineers, superintendents, and managers, who are familiar with the imperfections of the ordinary cars.

Any further information in regard to this invention may be obtained by addressing the New England Car Company, 48 Congress street, Boston, Mass. Mr. Simeon Brownell is general manager and sole agent for the United States.

THE GOWER SYSTEM OF TELEPHONIC COMMUNICATION, PARIS.

At present there are two telephone companies in Paris, one using the Gower telephone, the other the Edison. A third company introduced the Blake transmitter, but was soon consolidated with the Gower Company, who were the first to introduce telephonic communication in Paris. The Gower telephone, of which an exterior view and sections are shown in Figs. 1, 2, and 3 of the annexed engravings, requires no battery, as the currents for transmission of sounds are generated by the instrument, and it is provided with a peculiarly arranged magnet, by means of which a sound resembling that of a trumpet can be produced for signaling. Each subscriber is provided with a telephone connected with the main central office by means of an insulated wire, which is laid underground. A great difficulty is experienced in insulating the wires sufficiently to avoid the effects of induction. When several wires pass in one direction they are united in a cable, and the covering of the wires is of different colors, so that a wire may be traced very readily in case of accidents. At the central office the cable is separated, and each wire is conducted to its special office connection. To better explain the operation of this telephone system we will describe it in action. Each subscriber is known by a certain number. Assuming that No. 5 desires to communicate with another subscriber, he gives the signal by blowing into the tube of his telephone.

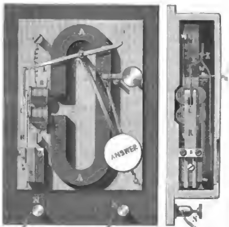


Figs. 1, 2 3.—THE GOWER TELEPHONE.

The Gower Company, desiring to maintain the simplicity of the instrument, have adopted a signaling device invented by Mr. Ader, which answers in every respect. It is illustrated in Figs. 4 and 5. A is the magnet of a telephone, and the subscriber's wire communicates with the bobbins, B B. R is the vibratory tongue, fixed at its lower end. The signal consists of a white disk with the word "Answer" printed on it, and it may also bear the number of the corresponding subscriber. This disk is attached to a pivoted lever, which can be locked in an inclined position, so as to keep the disk out of sight by means of a rod attached to it and terminating in a triangular stud, which passes into a slot in the upper end of the vibratory tongue, R. The signal disk will drop until its lever arm is perpendicular, when released by the vibration of the tongue, R, and it will then be visible through an opening in the box of the apparatus. When the sound signal is given the plate, R, vibrates, and at each vibration the triangular stud, U, will slip out of the slot in the plate a very short distance and finally leave it altogether when the disk shows. The sound signal is required to operate this visible signal, as the vibrations produced by the ordinary speaking are not powerful enough to operate this mechanism.

A call bell is sometimes arranged so as to sound when the disk drops, and it is of great service in case the switchman is not at his post, as it calls attention to the fact that he is wanted. Generally six signaling devices are arranged in one box, as shown in Fig. 7, and the signal box with the call bell is arranged above the switch, as shown in Fig. 8.

The subscribers' wires are arranged in groups of about thirty, those persons communicating with each other very frequently being united in one group. Each switchman has charge of a signal box and switch, represented in Fig. 8, which shows only ten subscribers, whereas there are twenty to thirty or more in each division, as before stated. A box containing the Ader signals is represented in the upper part of the cut, the white circles, with the numerals above them, representing the small windows or openings through which the disks can be seen when they have dropped.



Figs. 4, 5.—THE SIGNALING APPARATUS.

The call bell, which can be brought into action when required by means of a commutator, I, is mounted on top of the signal box. The plug switch, which is arranged below the signal box, consists of a series of vertical bars of metal, one for each subscriber, and a series of horizontal bars of metal arranged behind the vertical bars in such a manner that the two series do not touch each other, but are perforated at the crossings, so that a communication between a vertical and a horizontal bar can be established by passing a plug through the said perforations at the intersection of the bars. Each vertical bar is provided with a pin, and in Fig. 8 all the pins are represented as connecting the vertical bars with the lowest horizontal bar connected with a ground wire. Supposing the subscriber to have given his signal, and thus notified the switchman that he desires to communicate with another subscriber, the switchman takes the plug from the transverse bar and places it into the aperture at the crossing of the bar, No. 5, with the second horizontal bar, and he is now in communication with No. 5, and asks him with whom he desires to communicate. No. 5 replies that he desires to be connected with No. 9. The employe then resets the signal of No. 5, and connects No. 9 with the second bar by means of the plug in the manner described, and is thus in communication with No. 9, and gives the signal, which may be a simple sound signal, the Ader visible signal, or the call bell, as the subscriber may have arranged it at his house or office. No. 9 is then notified that No. 5 wishes to communicate with him, and No. 5 is notified that No. 9 is ready, the pins of the vertical bars, Nos. 5 and 9, having been placed above one and the same transverse bar, for instance, A, Nos. 5 and 9 are connected, and can converse with each other with complete privacy.

Fig. 7.—ANNUNCIATORS.

It must be stated that the disks of 5 and 9 have been raised, and as soon as their conversation is over Nos. 5 and 9 blow into the tubes of their telephones, thus notifying the switchman, who places the two plugs back in the bar connected with the ground wire. But if No. 3 and 7 wish to communicate at the same time that 5 and 9 are in communication, the pins belonging to 3 and 7 must be passed into the apertures at the intersection of the vertical bars, 3 and 7, with the second transverse bar, B, and in like manner, the next two subscribers are connected by means of the bar, C, and so on. These connections, however, only relate to subscribers of one and the same group or division. If the subscribers belong to separate divisions the connections are a little more complicated. If, for instance, No. 5 notifies the switchman that he desires to converse with No. 88, who is not in his group, which may be designated by A, and comprises the subscribers from 1 to 30, but probably will be found in group, C, comprising the subscribers from 60 to 90, the switchman passes the pin of No. 5 through one of a number of horizontal bars located between the bar, D, and the second bar, not shown in drawings, and then writes on a slip of paper: "The subscriber 5, group A, line 6 (for example), desires to be connected with No. 88, group C," and sends this slip to the group C. The switchman in charge of this group notifies No. 88, and then connects him with the line 6. He then sends the slip to the employe in charge of the grand commutator, where the groups A and C are connected in the line 6, thus permitting No. 5 to converse with 88. As soon as they have completed their conversation they give the signals, and all the pins are replaced into their former position.

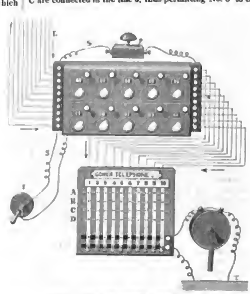


Fig. 8.—ANNUNCIATORS AND SWITCHES.

In the annexed cut we give an exact representation of the central station, showing the cases of each group arranged along the wall, and the grand commutator which connects 50 lines in the rear.

This system requires no batteries either for calling or transmitting. There are at present one hundred subscribers connected in Paris, and five hundred applications have been received.—*La Lumière Electrique.*

CENTRAL OFFICE.

NEW INVENTIONS.

Messrs. Jacob Waggoner and George E. Waggoner, of Perrin, Mo., have patented an improved harrow so constructed that it may be adjusted wide or narrow, as the work to be done may require.

A simple and effective machine for moulding and pressing bricks has been patented by Mr. James A. Reeder, of Corinth, Miss. The invention consists in combining, with a brick machine plunger, graduated arms to raise and lower it, for the purpose of regulating the quantity of clay that enters the mud box.

A lamp stand or body of separate parts that fit within or over each other and are held together by one bolt, and provided with detachable handles or side ornaments, has been patented by Mr. Joseph Klotz, of West Meriden, Conn.

An improved salt cellar and pepper box, patented by Mr. William C. Beattie, of Taunton, Mass., consists in an ovalbottomed egg-shaped metal box, divided transversely, and having its sections connected detachably with a screw-thread, and having also one end perforated with holes through which the salt or pepper can be sifted, and the other end weighted or slightly flattened, or both, so as to cause the box to set upright.

AGRICULTURAL INVENTIONS.

Mr. Joseph Amstutr, of Harlan, Ind., has patented an improved rake reel for reapers and mowers, which is so constructed as to raise and straighten fallen, lodged, tangled, and twisted grain and grass, and hold them in proper position while being cut, and thus allow the machine to cut short, tall, lodged, fallen, tangled, and twisted grain and grass with facility and thoroughness, leaving no scattered stalks and leaving grain in good condition for being bound.

Mr. William S. Neal, of Perdue Hill, Ala., has invented a combined cotton chopper and cultivator, so constructed that it may be readily adjusted as the character of the work to be done may require.

An improvement in the class of grain drills or seeders whose drill tubes have detachable points or hoes has been patented by Mr. William H. Wilson, of Xenia, Ohio. The improvement consists in constructing the point or hoe proper with a tubular shank, and in securing it to a drill tube by a wedge.

An improved grain rick frame has been patented by Mr. Cornelius Geiger, of Tarborough, Ga. This invention relates to portable grain supporters, the object of which is to secure small grains from damage when stacked in the straw, especially on bottom lands subject to overflow, and particularly adapted for the use of rice planters.

Correspondence.

The Edison Light

To the Editor of the Scientific American:

With this I send you the report of Profs. Brackett and Young on the efficiency of Mr. Edison's machine for generating electricity.

As undoubtedly comparisons will be drawn between the figures there given and those which have been given by Dr. Hopkinson for the Siemens machine, an analysis of his figures is not out of place. In *Engineering* for May 9, 1879, a full report of the tests of Dr. Hopkinson may be found.

He assumes, in calculating the work which is done in the circuit, that a gravity Daniell's cell has an electromotive force of 1·125 volts, though this form of cell is the weakest of any. In the calculations which the makers of other machines have rated the efficiency of their machines, 1·079 volts has been assumed as the electromotive force of a Daniell's cell. As the work varies with the square of the E. M. F., his figures for work in the current must be multiplied by $\left(\frac{1{\cdot}079}{1{\cdot}125}\right)^2 =$ 0·919; that is, 91·9 per cent of the work given by his figures should be taken in comparing the Siemens with other machines. I take experiments 9, 10, 11, and 12 as representing very nearly the conditions of practical use. These show, according to his figures, 3·908 erg-tens in the current to 4·161 erg-tens given the machine by the belt, or 91·5 per cent as the efficiency of the machine. Using the correction mentioned, 84 per cent will be the true number. Taking the resistance of the machine as 0·683 ohm, which it would be after running a short time, these experiments show 52 per cent in outside work; that is, of 5·55 horse power given the machine by the belt, 2·89 horse power were effective outside.

Profs. Brackett and Young show 90·7 per cent converted, and 83·9 available outside.

I hope this statement will be sufficient to end the discussion into which I was drawn some time since regarding Mr. Edison's machine. He then claimed that $\frac{4}{5}$ of the power in the current could be made available; now tests show $\frac{11}{12}$ of the energy in current are available.

It is not "childish," then, to make an armature with about one eighth of an ohm resistance, as was claimed by others at the time.

Yours,

FRANCIS R. UPTON.

REPORT OF COMPARISON BETWEEN THE PRONY AND EDISON DYNAMOMETERS, AND UPON THE EFFICIENCY OF THE EDISON DYNAMO-ELECTRIC MACHINE, BY PROFS. C. F. BRACKETT AND C. A. YOUNG, OF THE COLLEGE OF NEW JERSEY, PRINCETON, N. J.—EXPERIMENTS MADE APRIL 3, 1880.

FIRST COMPARISON BETWEEN THE DYNAMOMETERS.

The lever arm of the Prony was held down by the action of a spring balance applied at division 12, corresponding to a virtual circumference of 12 feet. The weight of the balance was 5·41 pounds, which is to be added to all its readings. The balance was read by Mr. Upton. After the experiment, the Edison dynamometer, transmitting no work, as read by Prof. Brackett, indicated (the mean of five readings, ranging from 990 to 995) 994·2 pounds. During the experiment the readings were made by Prof. Brackett and recorded by Prof. Young.

Duration of test, 10 minutes.

Number of revolutions of Prony shaft, determined by counter, 5,664.

Number of revolutions of main shaft, 1,880.

Mean indication of Edison dynamometer, deduced from Prof. Brackett's ten readings, varying from 920 pounds at beginning to 935 at end of experiment, 925·7 pounds.

From this, taking the mean reading of the zero, 994·2 pounds, we have $\frac{994{\cdot}2 - 925{\cdot}7}{2} = 34{\cdot}25$ pounds.

Mean tension on Prony arm, 9·011 pounds, varying gradually from 10·21 pounds at beginning to 7·66 pounds at end of experiment, including weight of scale.

Work registered by Prony, 9·011 (lb.) × 12 (ft.) × 5,664 (rev.) = 612,460 ft. lb.

The diameter of main pulley is 38 inches.

The angle between belts of Edison dynamometer is taken at 44°. Assume $K = \left(\pi \times \text{sec. } 22° \times \frac{38}{12}\right) = 10{\cdot}7297$. Then the Edison dynamometer registered K (ft.) × 1880 (rev.) × 34·25 (lb.) = 690,880 ft. lb. That is, the Prony recorded 88·6 per cent of the work carried by the Edison dynamometer.

The comparison does not seem to us satisfactory on account of the considerable change in the conditions during the experiment.

SECOND COMPARISON.

Constants and observers as before.

Duration of test, 4 minutes.

Number revolutions of Prony, 2,281.

Number revolutions of main shaft, 752.

Mean tension on arm of Prony, 11·35 lb., varying from 11.60 to 10·97 in seven readings.

Initial reading of Edison dynamometer (mean of five), 994·2.

Final reading of Edison dynamometer (mean of five), 994·2.

Mean during comparison, 911·57.

(Mean of seven readings, varying from 910 to 915 lb.)

Work according to Prony, 11·35 (lb.) × 12 (ft.) × 2,281 (rev.) = 310,680 ft. lb.

Work according to Edison instrument, K (ft.) × 752 × $\left(\frac{994{\cdot}2 - 911{\cdot}57}{2}\right)$ = 333,360 ft. lb.

In this comparison the Prony registers 93·2 per cent of work indicated by the Edison dynamometer.

We regard this test as fairly reliable, the conditions having been very constant, and the outstanding difference of 6·8 per cent being reasonably accounted for by slip of belts and friction of journals between the two dynamometers.

TESTS OF THE EFFICIENCY OF THE DYNAMO-ELECTRIC MACHINE.

During both these tests the thermometer of the calorimeter and the Edison dynamometer were read as often as every minute, and great pains were taken to keep the water thoroughly stirred. The calorimeter was a galvanized iron vessel, 16·42 inches in diameter and 24½ deep.

The wire coil was wound upon a light wooden frame, so constructed as to serve as a very efficient stirrer.

The thermometer was an excellent instrument, by James Green, graduated to fifths of a Fahrenheit degree, each degree being about three-sixteenths of an inch in length.

Prof. Brackett read the dynamometer.

Prof. Young read the thermometer and made the records.

Mr. Upton and others, the speed of the main shaft and the indications of the high resistance galvanometer in the laboratory.

CONSTANTS.

Weight of calorimeter (empty)	22·63 lb.
Heat capacity of same (taking specific heat at 0·112)	2·53 lb.
Weight of wooden frame	5·71 lb.
Heat capacity of frame (s. taken at 0·30)	1·71 water lb.
Weight of wire coil (341¼ turns, each turn weighing 5·84 grammes)	9·70 lb.
Heat capacity of wire (s., 0·10)	0·97 water lb.
Resistance of coil in calorimeter	1·720 ohms.
Resistance of leading wires taken as $\frac{1}{300}$ of coil	0·0057 ohm.
Resistance of wire on revolving armature	0·140 ohm.
Resistance of coil on field magnets,	1·470 ohms.

FIRST TEST.

Total weight of calorimeter with contained water and everything in place	197·5 lb.
Hence from preceding data the heat capacity of whole	172·77 water lb.
Temperature of air	72·2°
Temperature of water at beginning	63·8°
Temperature of water at end	80·5°
Gain during experiment	16·7°
Duration of experiment…13m. 50s.	13·83⅓ m.
Dynamometer at beginning (free)	994·2
Dynamometer at end (free)	995·
Mean dynamometer zero	994·6
Speed of main shaft, beginning	174 per min.
Speed of main shaft, end	170
Mean	172
Mean reading of dynamometer during experiment	771·75 lb.

(Varying from 760 to 781, 16 readings.)

E. M. F. of current maintaining field was 61 divs. of galvanometer, on which 168 d. corresponded to 16 Daniell cells, *i.e.*, E. M. F. $= \frac{61}{168} \times 16 \times 1{\cdot}079$ volts.

Energy expended on driving armature, as indicated by dynamometer = K (ft.) × 172 (rev.) × 13·83⅓ (min.) × $\left(\frac{994{\cdot}6 - 771{\cdot}75}{2}\right)$ = 2,844,600 foot pounds.

Energy expended on field of force, $\frac{6}{5} \times \frac{45{\cdot}25 \text{ (ft. lb.)}}{1{\cdot}47 \text{ (ohms)}} \times 13{\cdot}833 \text{ (m.)} \times \left(\frac{61}{168} \times 16 \times 1{\cdot}079\right)^2 =$ 16,634 foot pounds.

Hence, total energy expended, 2,864,234 foot pounds.

Energy Realized.

a. In calorimeter = 772 × 172·77 × 16·7° =	2,227,420 ft. lb.
b. In leading wires $\frac{1}{300}$ of above	7,425 ft. lb.
c. In armature $\frac{14}{172}$ of calorimeter,	181,302 ft. lb.

Hence,

Total energy realized	2,416,147
Total available (*a* + *b*)	2,234,845

Hence,

Total efficiency	84·5 per cent.
Total available	78·2 per cent.

Remarks.

During this test the driving power was about 6½ horse power; the electromotive force of the field current, 6·27 volts, giving a current through the magnet wires of about 4¼ webers; and the current developed by the machine was about 45·8 webers through a total resistance of 1·866 ohms.

SECOND TEST.

Total weight calorimeter and contents	200·00 lb.
Hence by preceding data, heat capacity =	175·27 water lb.
Temperature of air	71·1° to 71·8°
Initial temperature of water	63·2°
Terminal temperature of water	79·9°
Gain	16·7°
Duration of experiment	9 minutes.
Speed of main shaft, beginning	176 per m.
Speed of main shaft, middle	173 per m.
Speed of main shaft, end	177 per m.
Mean	175·83
Dynamometer reading before exp.,	985
Dynamometer reading after exp.	995
Mean dynamometer zero	990
Mean reading of dynamometer during the experiment (9 readings, between 645 and 666)	656
Electromotive force of field (by high resistance galvanometer) = $\frac{145}{168} \times 16 \times 1{\cdot}079$ =	14·901 volts.
E. M. F. of dynamo current = $\frac{240}{51} \times 20 \times 1{\cdot}079$ =	101·55 volts.
E. M. F. of terminals of dynamo; current broken, $\frac{290}{51} \times 20 \times 1{\cdot}079$ =	122·71 volts.

Energy Expended.

a. In driving armature according to dynamometer; K × 175½ (rev.) × 9·0 (m.) × $\frac{990-656}{2}$ =	2,827,550 ft. lb.
b. In maintenance of field of force, $\frac{6}{5} \times 44{\cdot}25 \text{(ft. lb.)} \times 9 \text{(m.)} \times \frac{(14{,}901)^2}{1{\cdot}47}$ =	72,180 ft. lb.

Hence,

Total energy expended	2,899,730 ft. lb.

Energy Realized.

a. In calorimeter, 772 × 175·27 × 16·7° =	2,259,700 ft. lb.
b. In leading wires $\frac{1}{300}$ of above	7·532 ft. lb.
c. In armature $\frac{0{\cdot}14}{1{\cdot}72}$ of *a*	183·930 ft. lb.
Total energy realized (*a* + *b* + *c*)	2,451,162 ft. lb.
Available (outside of machine) (*a*+*b*),	2,267,232 ft. lb.

Hence,

Total efficiency	84·5 per cent.
Available efficiency	78·2 per cent.

Remarks.

As a check we may compute the total efficiency from the galvanometer reading and the resistance: Energy developed. 44·25 (ft. lb.) × 9 (m.) × 101·55 (volts) × 1,866 (ohms) = 2,200,500 ft. lb.

The discrepancy is fairly explained by the defective insulation of long wires leading to the galvanometer, as it was raining at the time.

During the experiment the driving power was about 9½ horse power, and the current was 57·4 webers (according to galvanometer, 54·4).

Even with this current the spark at the commutator was very trifling.

SUMMARY.

	Total Efficiency.	Available Efficiency.
According to first test	84·5 p. c.	78·2 p. c.
According to second test	84·5 p. c.	78·2 p. c.

The Prony dynamometer is connected to the Edison dynamometer by a belt from the same countershaft, which is also belted to the electric generators. If we should assume the correctness of the Prony, and that the loss in the transmitting power between the Edison dynamometer and the arbor of the armature was only the same as between the two dynamometers, the above numbers would have to be increased in the ratio of 100 to 93·2 (see above), and we should have:

Total efficiency	90·7
Available efficiency	83·9

C. F. BRACKETT,
C. A. YOUNG.

Princeton, N. J., April 10, 1880.

AMERICAN INDUSTRIES.

[Continued from first page.]

also the cutting of the inner lining, which is of coarser and heavier muslin, to hold the starch better, and a collar is styled three, four, five, or six ply according as it has one to four pieces between its outer and inner sides.

From the cutters, the goods go to the room shown in one of the upper views, where the various pieces are "assembled," as it may be called, that is, a sufficient number of pieces of each kind to make two dozen shirts, with the stock necessary for their finishing, are put together in one bundle, ready to give to those who do work outside of the factory, or to send to the stitching room on the premises. All the orders for goods of different kinds and styles have here to be closely looked after to see that the work is started right.

The stitching room, as shown in the view on the left at the bottom of the page, presents no features of especial novelty, except for the great number of sewing machines at work. Great care must be taken to keep the work free from oil, and so preference is given to a machine which will require little lubricating, and at the same time can be run at a high rate of speed. A number of buttonhole machines are employed, but a portion of this work is also done by hand.

Making the folds on the edges of collars and cuffs and the plaits in bosoms is shown in the view at the top, in the center. A machine introduced for this purpose within the past two years has proved very successful. The edges are folded down or the plaits laid by a metal former, when they receive a quick pressure from heated plates, which puts them in the exact position required, and so that they retain the form thus given until the stitching is done. At the right of this picture is seen a representation of the turning room, where the collars, which have been stitched wrong side out, are turned and the seams pressed out. This work is all done by hand.

The view of the packing room, as seen in the middle, explains itself. The pasteboard boxes used are made for the firm by a local factory, where little else is done than supply this demand.

The laundering of the shirts and collars forms a separate department of the business, not shown in our engravings. In the collar laundry about 100 hands are employed, and rather more than that number in the shirt laundry. A good deal of machinery is used in this part of the work, including huge wash wheels, which will take in four to five hundred dozen collars and cuffs at one time; centrifugal wringers, which turn at the rate of a thousand revolutions a minute; immense starch wheels, steam ironers, etc. In addition to the starching done by machinery a large number of "hand starchers" are employed for the collars and cuffs, and the drying is all done by steam heat. The ironing machines consist of various arrangements of heated rollers and revolving drums, which give to the goods a smooth, fine finish, and all the work of washing, drying, starching, and ironing is performed so expeditiously that the laundry work is regularly kept close up to the production of the factory.

The cost of making a shirt runs from \$1.50 to \$3.50 a dozen, and, low as this price seems, and impossible as it would be for ordinary seamstresses to make a living in this way, there is never any difficulty found in obtaining all the help needed. There are about 300 hands employed in the building, of which 50 are men, but there are some 1,500 names on the pay-roll besides, of those who take out work to do at their homes in the city and for many miles around, so that, where the money thus earned does not go directly to the support of families and individuals, it enables those who are industrious and ambitious to supply themselves with many additional comforts and luxuries which they would not otherwise have. This is exclusive of the hands employed in the laundry work, which would make the total help engaged in shirt and collar making and laundering number fully 2,000.

The present firm was organized in 1865, but the business was established over twenty-eight years ago. The partners are all practically conversant with and take an active part in the work. Their goods are sold only to jobbers: in New York, from No. 87 Franklin street; in Boston, by Whittemore, Cabot & Co.; and in Philadelphia, by W. L. Wetherly.

The Nature of Light and its Action upon the Eye.

At a recent meeting of the Buffalo Microscopical Club, Dr. Lucien Howe presented the subject of the undulations of light and their perceptions by the eye. Brief mention was made of the different theories, accounting for the phenomena of optics previous to the present century. The difficulties of this subject were first solved by Thomas Young, who satisfactorily explained the undulatory theory of light. He showed that what we call light is an impression produced upon the retina by the wave-like motion of the particles of matter. Subsequently the lengths of these waves were measured. It would take 36,918 waves of red light, or 64,631 waves of violet light, placed end to end, to make an inch. From the speed of light, which has been measured, it is proved that at least four hundred and fifty one millions of millions of these minute waves flow into the eye and dash against the retina in each second. Dr. Howe proceeded with a minute description of the microscopical anatomy of the eye, more particularly relating to the "layer of rods and cones." These were stated as being in reality the terminal filaments of the optic nerve. These are shaken or acted on by the waves of light, and it is especially these with which we see.

The Proposed Illinois Ship Canal.

Mr. Daniel C. Jenne, Chief Engineer of the Illinois and Michigan Canal, contributes to the Chicago *Inter-Ocean* the following account of the proposed through water route from the great lakes, at Chicago, to the Mississippi River:

The first division of the project consists in the enlargement of the Illinois and Michigan Canal from Chicago to Joliet. The present canal was built 48 feet wide on the bottom, with side slopes 1 to 1 in earth, making 60 feet surface width at 6 feet deep, or below the low water of Lake Michigan, with a descent on the bottom of one-tenth foot per mile across the Summit level, toward Joliet. It is proposed to make the enlarged canal 144 feet wide on the bottom, side slopes 1 to 1 protected by slope wall in earth, and 160 feet wide at surface at 8 feet deep, or below low water of Lake Michigan, with a descent of two-tenths foot per mile. This will pass 112,321 cubic feet of water per minute, and give a current of 1·06 miles per hour. The average stage of water in Lake Michigan for the last eight years has been about 2 feet higher, which would make the water 10 feet deep, and would pass 158,538 cubic feet per minute, with a current of 1·19 miles per hour.

The canal enters the Desplaines River about one mile and a half north of the main street at Joliet, or nearly opposite the State Penitentiary, and will be about 33 miles long. The work of enlargement consists of about 15,000,000 cubic yards of excavation, including the removal of spoil banks made from the excavation of the present canal, of which there will be about 4,000,000 cubic yards of solid magnesian limestone to be excavated. Three lift-locks will be required at the southern end, one grand lock at Bridgeport or north end, six public road and street drawbridges, and one double railroad drawbridge, and a large water weir at Lockport. The locks are to be 350 feet long between the gates and 75 feet wide, to correspond with those now built on the Illinois River.

The second division extends from one and one-half miles above Joliet to La Salle, about 67 miles, and will consist of the improvement of the Desplaines and Illinois rivers by locks and dams, and an independent short piece of canal around the rapids at Marseilles. It will require the construction of eleven locks, nine dams, the raising of two dams, nine drawbridges, the independent piece of canal above referred to, and other incidental work.

The third division consists in the improvement of the Illinois River from La Salle to Grafton, on the Mississippi River, and was described in my former communication, distance 227 miles. Of this, 90 miles have been finished by the construction of two locks and dams.

COST OF THE WORK.

The estimated cost of the first division, 33 miles, is...	\$11,312,932
Estimated cost of the second division, 67 miles, is......	4,347,879
Estimated cost of the third division, 227 miles, is......	1,000,000
Total cost to complete 327 miles..................	\$16,660,811
There has been expended by the State on locks and dams..........	747,767
There has been expended by the United States on locks and dams..........	62,340
There has been expended by the United States on dredging wing, dams, etc..........	726,000
Amount already expended..................	\$1,536,107
Total estimated cost of the entire work..........	\$18,196,918

The item of work, quantity, and the estimate of cost on the first and second divisions are from the report of F. C. Doran, Esq., civil engineer, who made a survey of the same in the fall of 1874, under the direction of Colonel J. N. Macomb, Corps of Engineers, United States Army.

According to these estimates the canal, 327 miles long, will cost \$55,560 a mile, and will have twelve times the capacity of Erie Canal, which cost about \$90,000 a mile. This route opens an inland water communication between the Gulf of Mexico, New Orleans, St. Louis, and other cities of the great West and Southwest, through the city of Chicago, with the city of New York in one direction, and with the cities on the St. Lawrence River and the Gulf of St. Lawrence in another direction, and through both routes and the extremes with the Atlantic Ocean.

The dimensions of the proposed canal are sufficient to admit boats of 2,500 to 2,800 tons burden, being 80,000 to 85,000 bushels of grain, or one and a half to one and eight-tenths million feet of pine lumber; or fleets of smaller boats can pass the locks at the same time with about the same tonnage, or twelve of the boats of the Erie Canal, or the Illinois and Michigan Canal, can pass the locks at one lockage.

The summit level of the canal could be reduced to 100 feet on the bottom with the same slopes and declivity, and construct basins at every mile 500 feet long and 50 feet wide for boats to pass, and reduce the cost of the first division about \$4,000,000, and these at 10 feet deep would pass over 100,000 cubic feet of water per minute.

The Railway up Vesuvius.

The station is situated on a level spot on the west side of the mountain, about half an hour's walk from the observatory. The constructors of the railway have adopted the American double iron rope system. There are two lines of rails, each provided with a carriage divided into two compartments and capable of holding six persons. While one carriage goes up the other comes down, thus establishing a counterpoise, which considerably economizes the steam of the stationary traction engine. The incline is extremely steep, commencing at 40°, increasing to 63°, and continuing at 50° to the summit. Every possible precaution has been taken against accident, and the railway itself is protected against possible flows of lava by an enormous wall. The ascent will be made in eight to ten minutes, while before it required from one to two hours. To obtain the necessary supply of water, large covered cisterns have been constructed, which in winter will be filled with the snow that often falls heavily on Vesuvius. This snow will be quickly melted by the internal heat, and, besides the water thus obtained, the frequent rainfall will also be conducted into the cisterns.

MISCELLANEOUS INVENTIONS.

Mr. Oscar Kleinberger, of New York City, has patented an improved material for suspender straps or ends. It is made of duck, muslin, or other woven fabric, faced with oil cloth, the two being attached together, with or without a filler, in a solid compact sheet, from which the ends and other portions are afterward cut.

An improved apparatus for flooding oil wells has been patented by Mr. Henry R. Davis, of Pioneer, Pa. The object of this invention is to continuously flood or lubricate oil wells other than flowing oil wells with oil, to prevent the accumulation on their sides of incrustations of salt, lime, paraffine, or other oil deposits.

A portable lantern combined with clockwork mechanism, by which flashing or other signals may be given, so that the number of the signals may convey the desired meaning, has been patented by Mr. Romeo W. Lewis, of Sacramento, Cal.

Mr. William H. Maxey, of Homer, La., has patented a tether for securing horses and other stock while grazing, so constructed as to prevent the animals from twisting the tethers or becoming entangled in them, and also to limit the grazing area without moving the tether.

Mr. John K. Hogan, of Placerville, Cal., has patented a machine intended for splitting peaches and other fruits in halves and removing the stones in preparing the fruit for preserving, and is especially adapted for the varieties of peaches known as "cling-stones," which are generally preserved whole on account of the difficulty experienced in freeing the stones by hand.

Messrs. Lewis B. White and Leonard Henderson, of Middleburg, N. C., have patented a smoke and dust arrester for railway cars, which consists in inclosing the trucks of the cars in a housing having doors at the ends, which housings communicate with a pipe extending through the entire train, through which the air and dust from the wheels is drawn by a fan located in the rear car. Smoke may be drawn from a hood located above the smoke stack of the locomotive by the same pipe.

Messrs. Henry P. Gray and William Gray, Jr., of South Manchester, Conn., have patented an improved apparatus for dyeing and washing yarn, cloth, etc., adapted for use in connection with any desired number of vats.

An improved device for fastening an umbrella to the body of a person who is exposed to the rays of the sun during his work, has been patented by Mr. Thomas Mora, of Franklin, La. The invention consists of a tubular socket provided with side springs and of a tube provided with a laterally projecting ring, both of which are buttoned or otherwise fastened to straps or bands that buckle about the body.

An improvement in heating stoves, patented by Mr. John P. Oeth, of Caston, Mo., is designed to increase the heating surface of stoves, to prevent accidental contact of the body or clothing with the heated surface of the stove, and to enhance the appearance of the stove.

Mr. Hubert Child, of Wichita, Kan., has invented improvements in transparent signs. It consists in "cutting in" a transparent letter on glass by means of an opaque color, and placing behind the glass a packing of broken glass contained between two independent panes of glass, so that when the light from the rear shines through the transparent letter the plane character of said letter is broken up and diversified by the crystals of glass, which may be of different colors to produce a very brilliant and tasteful design.

Mr. William H. Burk, of Greencastle, Ind., has recently patented an ornamental and attractive apparatus for roasting and warming peanuts.

Mr. David N. Smith, of San Bernardino, Cal., has patented improvements in the construction of safes for receiving vegetables, food, clothing, and other similar articles, the object of the invention being to prevent the access of insects to the articles placed within the safe.

An improvement in crates for carrying fruits, eggs, and other perishable articles, has been patented Mr. George E. Bender, of Everett, Pa. The object of the invention is to provide a crate that is perfectly ventilated, and at the same time is arranged to exclude the cold and protect the contents against injury from the outside.

Mr. Edward Barnard, of Rome, N. Y., has patented a quarter boot for horses, having a soft leather body with stiff pads on the quarters, and a stiffening sole strip, the whole adapted to be held in place by straps and buckles.

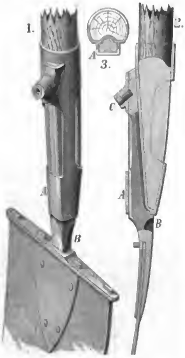
An improvement in gate latches, patented by Mr. Samuel B. Elzey, of Atlanta, Ga., consists in combining a pivoted latch carrying an arm, a sliding bar carrying an arm, and a spindle carrying an arm, so that the gate may be unlatched by turning the spindle.

Mr. William Linehan, of Chicago, Ill., has patented a device for automatically feeding the fluid for preventing incrustation into the boiler along with the feed water, when supplied by a pump or an injector. It consists of a reservoir for holding the fluid, from the bottom of which a siphon pipe leads to the pump barrel or injector at a point where the water is forced or drawn by suction into the boiler. The siphon pipe is supplied with a stopcock and check valve, to regulate the amount supplied and to prevent back pressure when pumping.

NOVEL TOOL HANDLE.

The annexed engraving shows an improvement in the class of tool sockets designed for application to wooden handles, and adapted for holding tools of various kinds, such as shovels, forks, spades, and other agricultural hand tools.

The socket is fitted to the lower end of the wooden handle, and has in its upper face a concave depression or groove for receiving the shank, B, of the shovel, spade, or other implement, in connection with which the handle is used. Over the groove in the socket there is at the upper end a keeper or loop, provided with a set screw, C, for holding the shank, and at the lower end of the socket there is a keeper or loop, A, that holds the larger part of the tool shank. The set screw is inclined at an angle to the shank, so that its tendency when tightened will be to draw the shank into the handle.



IMPROVED TOOL HANDLE.

This handle may be readily applied to any tool having a shank adapted to it by simply inserting the shank and tightening the set screw.

This useful invention was recently patented by Messrs. J. H Richardson and J. C. Calhoun, of Oakley, La., who may be addressed for further information.

NEW ROTARY ENGINE.

The annexed engraving represents an improved rotary engine recently patented by Mr. William N. De Groat, of Knoxville, Tenn., the patent being now owned by Messrs. W. N. De Groat and A. L. Maxwell, of same place.

The engine is shown in perspective in Fig. 1 and in section in Fig. 2. The revolving pistons are secured to a rotary disk, work in a stationary annular cylinder having three sliding abutments, C, which are operated at the proper instant by a cam, A, on the main shaft through a system of levers, B, and suitable connections. Steam and exhaust ports enter the disk at or near the center, and pass to its periphery in opposite directions, the steam supply port communicating with the cylinder through one face of the piston-head, and the exhaust port running through the opposite face. The exhaust ports are arranged so that the sliding abutments are relieved of steam pressure before it is moved, and it is restored to its place under a pressure which is balanced with the exception of the small area of the stem by which it is worked.

For convenience in reversing the engine there are steam ports on opposite sides of the piston, and a plug valve, D, in the disk is employed to change the direction of the steam supply and exhaust and thus reverse the engine. Steam is exhausted from the engine through the passage, *a*, and admitted through the central passage, *b*.

This engine has no dead points, and always works to its full power throughout its entire revolution. The inventor claims an advantage admitting and exhausting steam from the face of the piston, as the steam is not wiredrawn by passing through tortuous passages.

It is obvious that this engine requires no flywheel, as the motion is continuous, and not intermittent as in the case of reciprocating engines, and a great advantage in economy of steam is claimed, the power being applied directly and in the right place.

For marine engines the rotary form has many advantages that will be understood and appreciated by engineers. A study of the engraving, in connection with what has already been said, will be sufficient to make clear the construction and merits of this engine.

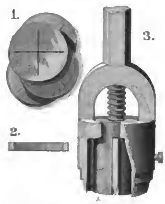
MECHANICAL INVENTIONS.

An improved device for use upon steam railroad cars, street railroad cars, at stations, and in other places, to indicate the name of the next station, street crossing, or other stopping place, the distance to it, and the time when due, and also, when used at stations, to indicate the next train and the time of departure or arrival, has been patented by Messrs. John B. Herbert and Charles Layton, of Old Bridge, N. J.

An improved pitman connection has been patented by William F. Rundell, of Genoa, N. Y. The invention consists in a wrist pin made of two diameters, a box having tangs or shanks to be bolted to the pitman, which box is arranged to bear in the plane of the larger diameter of the wrist pin, the pitman being prevented from slipping off by a flange on the inner sides of the box extending down to and fitting the smaller diameter of the wrist pin, while a gasket and circular plate on the outside is screwed to the box to inclose the wrist pin and make an oil-tight bearing.

IMPROVED GUN WAD.

The annexed engraving represents a gun wad specially adapted for loading and discharging shot from a fowling piece. Gun wads have been made of concavo-convex form in such a manner that when pushed into a gun barrel or cartridge shell by means of the square end of a ramrod or plunger they would expand under pressure to fit tightly upon the charge. Flat wads have also had their edges or perimeters scalloped or pinked, so that a wad larger than the bore of the gun or cartridge could be readily crowded in upon the charge, to be retained by the elasticity of the compressed serrated or pinked edge of the wad. In both instances the wad leaves the gun intact and impedes the flight of the shot and affects their direction and force. The invention shown in the engraving is intended to compress and pack a wad tightly upon a charge of shot in a gun barrel or cartridge shell, in such a way that it will remain intact until moved by the explosive force of the powder, when it will open in its center and sever into quarter sections, and allow the charge of shot to virtually fly through the wad without being impeded or misdirected by the fragments of the wad. This is accomplished by forming a crosscut or a series of radial incisions in a wad by means of the combined hollow punch and a solid four-bladed cutter, shown in Fig. 1.



NEIMEYER'S GUN WAD AND PUNCH.

The wad is intended to be used only over the shot, and when the gun is discharged the parts of the wad will be found upon the ground from five to six feet ahead of the muzzle of the gun. By the use of this wad no obstruction to the direction or force of the shot is offered, and the pattern is thereby improved and the penetration increased.

Further information may be obtained by addressing Mr. Jacob Neimeyer, Atlantic, Ia.

Fig.1

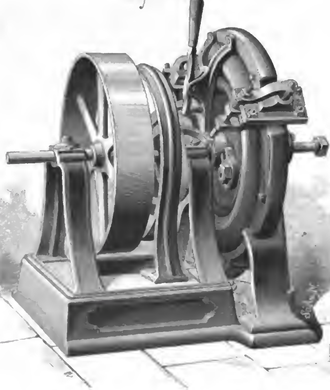
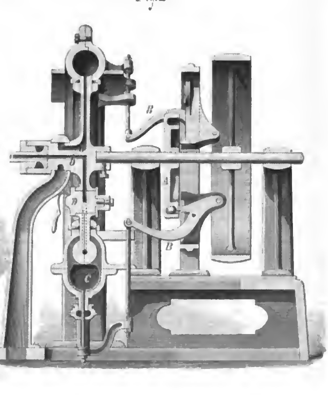


Fig.2



DE GROAT'S ROTARY ENGINE.

A CHAPTER ON TROUT.

BY DANIEL C. BEARD.

Brook trout are always associated in my mind with delightful scenery, clear, swift running water, and bracing air, and I am sometimes tempted to think that it is the association that lends such a delicate flavor to their meat. As Aldrovandus quaintly expresses it, "The salmon, the grayling, and the trout, and all fish that live in clear and sharp streams, are made by their mother nature of such exact shape and pleasant colors purposely to wite us to joy and contentedness in feasting with her." St. Ambrose of old called the grayling the "flower fish." While making a drawing of the *Thymallus Americanus* at Fulton Market, Mr. Seth Green said: "Can you paint the rainbow? If not, do not attempt to reproduce the beautiful tints that glisten and flash upon the dorsal fin of the grayling." Not being able to "paint the bow upon the bended heavens," I was compelled to content myself with black and white, hoping at least to give some idea of the shape and form of this and other graceful and odd fish exhibited at the opening of the trout season by Mr. Eugene Blackford at his place in Fulton Market.

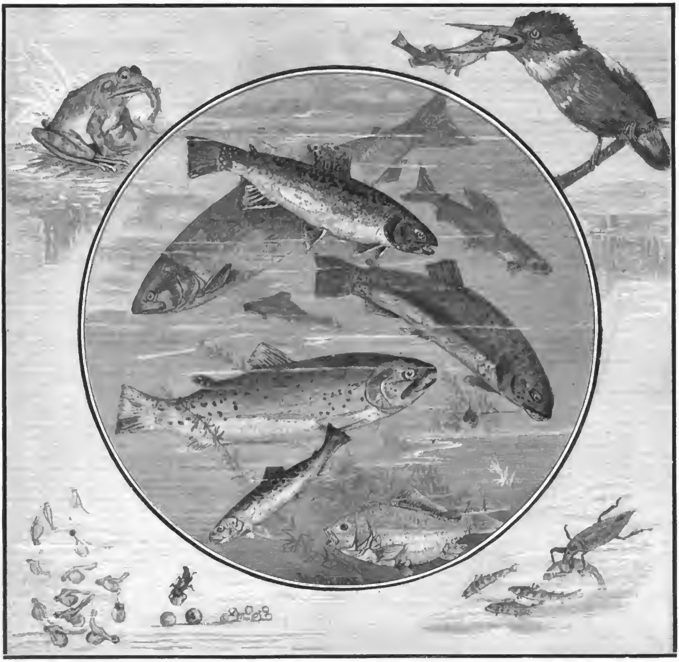
With the energy and goaheaditiveness for which Mr. Blackford is noted, he collected for the inspection of the pisciculturist, naturalist, and angler, all the procurable varieties of trout specimens of the *Salvelinus fontinalis* from England, Scotland, Ireland, France, Germany, Canada, Maine, New Hampshire, New York, Long Island, New Jersey, Wisconsin, Pennsylvania, Illinois, California, Maryland, Utah, and Colorado. There could also be seen trout from all the leading fish-culturists and fish commissioners of the United States, eggs and live trout, from those who just escaped the egg with the abdominal sac still attached, to the full grown fish disporting themselves in glass jars and tanks of crystal waters.

The first fish laid before me was a male trout from Shaster County, California, sent by B. B. Redding, Commissioner of Fisheries, measuring a little over two feet in length and weighing five and three-quarter pounds, well shaped and plump; on its body a paucity of red spots, but large black dots are sprinkled thickly upon the shoulders and tail; the operculum is decorated with a bright red tint, vanishing or blending into a greenish brown or olive toward the eye. A broad red dash of color extending from tip of tail to cheek gives this fish a very gaudy appearance. "Here," said Mr. Blackford, "is a remarkable fellow from the hatching house, McCloud River, California. It is called the 'Dolly Varden.'" And he placed before me a five and a half pound trout, round and dumpy, large odd head, an abnormal adipose fin, the other fins and tail short. In the place of the usual markings of his family, this fish was covered with large red semi-annular blotches. A slit cut in its back by Mr. Seth Green showed the flesh to be a rich salmon color. After making a careful drawing of this odd Western trout, Mr. Green placed before me an interesting hybrid, a cross between the California salmon and the common brook trout of New York. It was two years old when killed, and measured nine and a half inches in length, of a bluish slate color, no red, but a few yellow dots sprinkled sparsely along each side of the lateral line; a rather small head and graceful body, it partook of the nature of both its parents, with a strong leaning to the brook trout. Another three year old hybrid, measuring fourteen inches, looked more like a salmon.

The *S. fontinalis*, from France, is a well shaped fish, the one drawn measuring fourteen inches in length. A few red spots dot the space between the dorsal fin and the tail; dark spots commence at the gills and scatter over the space above the lateral line on its side and back to the caudal fin. Hon. Thomas Clapham sent some very graceful dark colored trout, averaging about twelve inches in length and two and a half inches in width at the dorsal fin. Hugh McGovern's trout were very like Clapham's, but lighter in color. The fish from the South Side Club, Oakdale, are much lighter in color, broader, and prettily marked. The specimen given me to sketch measured eleven inches in length and three and one eighth inches greatest width. The silvery sheen of its abdomen contrasted strikingly with the carmine hue of the abdomen of some of the wild trout from Canada. It would be an interminable task to mention, much less describe, all the fish that lay upon the marble slabs or swam in the aquariums. Says Isaak Walton: "I am certain if I catch a trout in one meadow he shall be white and faint, and as certainly if I catch a trout in the next meadow he shall be strong and red and lusty," and such is the case. Even the same trout that is light colored upon a white pebbly bottom will, chameleon like, change to a duskier hue if he swim over a dark mud bank.

At the bottom of the group of fish in the illustration is a picture of the German carp (*Cyprinus carpio*) sent to Mr. Blackford by the Smithsonian Institution. This fish will live in almost any half stagnant pond, and it is proposed to introduce it largely into this country. I have also drawn the portraits of a few of the marauders that pillage the fish ponds. It is wonderful, amid so many mortal foes, that a wild trout ever reaches maturity, but once gaining that age he revenges himself by feeding upon many of his former tyrants. Frogs, toads, lizards, aquatic insects, beetles and bugs, land rats, water rats, mice, minks, wild and tame ducks and geese, heron, and even cats never miss an opportunity and are ever upon the alert for a chance to devour the young trout or ova. Man lends a helping hand in this wholesale slaughter by turning the refuse of saw and paper mills and tanneries or other deleterious material into the streams. However, the sensible laws being enacted and enforced, and the efforts of a few enterprising men, will go far to counteract the mischief done.

The engineer of the Baltimore and Ohio Railroad who transported young black bass in the water tank of his engine and restocked barren streams, furnishes a noble example.



EXHIBITION OF FISH AT THE OPENING OF THE TROUT SEASON.

White Fish under the Microscope.

At a recent meeting of the Griffith Club of Microscopy (Detroit), Mr. J. C. Holmes, assisted by D. J. McGuire, M.D., gave a demonstration of the circulation of blood, illustrated by young whitefish from the Detroit "hatchery." The young fish, less than a week old, and looking not unlike a pair of eyes propelled about by an exceedingly active tail, were found, under the microscope, to be possessed of all necessary "interior" arrangements. As they are nearly as transparent as glass, the action of the heart in receiving and propelling blood, and the stream of blood corpuscles down one side to the tail, and back on the other, could be distinctly seen and examined.

The whitefish that are caught for this market are largely made to recognize their obligation to posterity, by passing through the "hatchery," where the *modus operandi*, as described by Mr. Holmes, is as follows: The eggs are stripped from the females by pressing the sides with the hands, and deposited in a large tin pan partly filled with cold water. Into this are placed two or three drops of milt, which is obtained by a similar process from one of the male fishes, and which contains the male principle of life—the microscopical spermatozoa. Each drop of the milt contains several thousands of these minute organisms, that would remain undeveloped but for the favorable conditions found in the female egg. These spermatozoa penetrate the eggs, and curling themselves up comfortably await the necessary five months to incubate. It is now the hatching season, and the unhatched eggs resemble a small pea, of a nearly transparent color, but with two distinct black dots on one side, which the microscope shows to be the eyes of the fish.

Temperature of the Soil during Winter.

The French physicists, Edmond and Henry Becquerel, took advantage of the intense cold prevailing at Paris last December, to study the changes in temperature below the surface of the soil under various conditions. It is a widely spread belief among farmers, that when protected by a layer of snow, crops sown in the autumn are effectually guarded against freezing. This opinion, however, must lose much of its weight in view of these late observations, which we will briefly summarize.

The observations were made by means of Becquerel's electric thermometer, which consists simply of two wires isolated by a coating of gutta percha, and soldered together at their extremities. Differences in temperature between the two places of junction cause electric currents varying in intensity with the greatness of the difference. A magnetic needle, brought under the influence of the current, registers on a dial these differences. The wires were inserted in the Jardin des Plantes at various depths, varying from 5 to 60 centimeters, and observations were made from November 26 to the close of December. Frost first appeared in the garden November 26. December 3 snow fell in abundance, and the temperature of the air sank to —11° C. The layer of snow was 25 centimeters deep. December 10, the temperature had sunk to —21°, and commenced then gradually to rise. December 15, the snow was 19 centimeters in depth.

Coming now to the observations made below the surface of the ground under the above circumstances, we find at once a striking difference between the results obtained in soil covered with grass and those obtained below a bare surface of the ground. In soil protected by grass, before as well as after the snowfall, at all depths below that of 5 centimeters, the temperature never descended below 0° C. Registering 3·5° at the depth of 5 centimeters on November 26, it slowly sank to 0·18° on December 14. The presence of grass would appear, then, to effectually protect the earth beneath it from freezing at the lowest temperatures attained in our climate. Quite different results, however, are yielded in the absence of grass. In this case, at a depth of 5 centimeters, the thermometer sank below zero on November 27. Two days later it registered —2·6°. On December 3, just before the snowfall, it reached its minimum of —3·17°. After being covered with snow it registered —0·8°, and later —1·4°. The snow here appears to act in a certain measure as a screen against changes in temperature, but its conductive properties are still too marked to prevent these changes from being felt sensibly at a certain depth in the earth. In the case of the agriculturist, this slow conduction, when united to the still slower conductive properties of a tolerably thick layer of dead shoots of cereal crops sown in autumn, may frequently insure immunity from freezing to the roots below the surface.—*T. H. N., in Nature.*

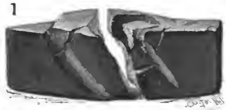
Manufacture of Ammonia.

A recent invention of J. P. Rickman, of London, for the manufacture of ammonia from the nitrogen of the atmosphere and the hydrogen of steam, may prove of some importance. The ammoniacal liquor produced in the manufacture of gas being now the chief source of ammonia, its value would considerably diminish should a cheaper source of that useful substance be discovered. Numerous endeavors have been made to convert into ammonia the nitrogen which forms the bulk of our atmosphere; but none have hitherto been a commercial success. We may mention Maxwell-Lyte's process of passing nitrogen and steam over an alloy of potassium and antimony, and Swindell's system of conducting a mixture of atmospheric air and steam through incandescent coke. Rickman's process is similar to that of Swindell. A series of inclined retorts are filled with coke and heated to 550° C. A mixture of twelve parts by volume of steam and five parts of atmospheric air is then introduced, and ammonia is formed and afterwards condensed in water. The most important point in working this apparatus is to maintain uniformity of temperature. Should the apparatus be too cool, no ammonia is formed; if the heat be too great, any ammonia which may have been produced is dissociated, and again resolved into the elements to which it owed its origin. This regulation of temperature was found to be so difficult to attain that an improvement has been devised which promises to overcome the chief obstacle to the successful working of the process. It is well known that chloride of ammonium is less easily decomposed at a high temperature than ammonia alone. Mr. Rickman, therefore, converts the ammonia into chloride of ammonium at the moment it is generated, which is effected by mixing common salt with the coal or coke used. It is claimed that by these very simple means ammonia can be produced at less than 1d. per pound.

Novel Test for Stone and Ore Breakers.

The annexed engravings are perfect representations of opposite sides of a hardened steel stone hammer which accidentally fell into the jaws of one of Marsden's improved stone and ore crushers manufactured at the Farrel Foundry and Machine Company's Works, at Ansonia, Conn., and doing work at South Easton, Mass.

1



2.

Hammer Crushed by a Stone and Ore Breaker.

This machine has positive motions and is constructed without springs or cushions to modify the action of the jaws. Nothing could exhibit the prodigious strength of this machine or its immense crushing power better than the sample of work presented in the engraving.

The hammer is of cast steel, hardened and tempered. It is eight inches long, three inches wide, two and a quarter inches thick, and weighs ten pounds.

The fractures and indentations in this solid piece of steel were made without the least injury to the machine.

ENGINEERING INVENTIONS.

Mr. John R. Jones, of Clarksville, Ia., has patented an improved railway car brake, the object of which is to give to the engineer of a train full control of the brakes without interfering with their operation by hand on each car. The invention consists in a pronged lever hung at each end of each car, the levers on each car being connected together and to the brake chains, and the levers being fitted for continuous contact throughout the train, so that when the brakes are applied on the tender by power from the engine there is a continuous or successive application of the brakes from the first to the rear car.

An improvement in governors, patented by Mr. William E. Crane, of Waterbury, Conn., consists in reciprocating a slide valve to regulate the supply of steam and the speed of machinery by connecting a pinion between two straight racks directly with the sleeve of the governor mechanism so as to raise and lower the pinion.

Mr. James N. Winn, of Darien, Ga., has invented an improvement in car couplings, so constructed that they may be readily adjusted to couple cars of different heights, that they will couple the cars automatically as they are run together, and will be readily uncoupled.

Mr. Allen A. Munson, of La Grange, Mich., has invented a combined elevator and carrier for unloading hay and depositing it in the mow, for loading and unloading vessels and cars, and for other uses.

Some improvements in steam engines have been patented by Mr. Samuel N. Silver, of Auburn, Me. These improvements relate to engines and pumps adapted for use with steam or water, and as stationary, marine, or locomotive engines, or as steam fire engines; and the object is to attain an engine of simple and durable construction adapted for running at high speed.

A spring draught attachment for horse powers has been patented by Mr. Asher E. Morris, of Janesville, Minn. The object of this invention is to connect the draught with the sweeps of horse powers in such a way that both the teams and the machines will be protected from jerk or strain should there be a sudden application of power.

The Mississippi River Commission.

The commission of engineers appointed to investigate the subject of levels and improvements along the Mississippi have submitted their reports.

The thirty-three navigable rivers of the Mississippi system comprise 14,000 miles of navigable waters, intersecting or bordering on eighteen States and two Territories. The extent of territory subject to overflow was, in 1874, estimated to be 41,193 square miles, an area as great as the combined areas of New Hampshire, Vermont, Massachusetts, Rhode Island, and New Jersey, and much more productive under proper conditions. Up to the year 1878 Congress had made for the improvement of the Mississippi river and its various tributaries about two hundred appropriations, amounting in all to the sum of $18,500,000.

The commission consists of Brevet General Q. A. Gillmore, president; Major Charles R. Suter, United States Engineers; Brevet Brigadier General C. B. Comstock, United States Engineers; Professor Henry Mitchell, of the Coast Survey; Captain James B. Eads, B. Harrod, and Benjamin Harrison, civilians.

The work assigned to them was:

First—To direct and complete such surveys of the Mississippi river between the head of the Passes, near its mouth and its headwaters, as were then in progress, and to make such additional surveys and examinations of said river and its tributaries as might by it be deemed necessary.

Second—To take into consideration and mature such plan or plans as will correct, permanently locate and deepen the channel, and protect the banks of the Mississippi river, improve and give safety and ease to the navigation thereof, prevent destructive floods, and promote and facilitate commerce and the postal service, and with such plans to prepare and submit estimates of the cost of executing the work.

Third—To report specifically upon the practicability, feasibility, and probable cost of the plans known as the jetty system, the levee system, and the outlet system.

Many plans for the improvement of navigation and the protection of the alluvial lands have been advocated, chief among them these:

First.—Improvement of navigation between St. Louis and the Gulf by the use of jetties to make the river of uniform width and scour out the channel.

Second.—Drainage and reclamation of the alluvial lands by a system of outlets which divide the great river into several lesser streams.

Third.—To cut away the bars obstructing navigation by building a wall across the river at its mouth.

Fourth.—Construction of an entirely new line of levees a mile or more back of present ones.

Fifth.—Repairing existing levees, closing all the outlets with wing dams to turn aside the current where the curves of the river are apt to cave in the banks.

There are also three other plans proposed:

First.—The cut-off plan for straightening the course of the river.

Second.—The diversion of tributaries, like the Red river, diverting them from pouring into the Mississippi.

Third.—The reservoir plan, the creation of basins or reservoirs at the sources of the Mississippi and its tributaries to gather the surplus water in flood time and reserve it to add to the current at low water periods.

The majority report of the commission, signed by the president and engineers Suter, Mitchell, Eads, and Harrod, states that, "in a restricted sense as auxiliary to a plan of channel improvement only, the construction and maintenance of a levee system is not demanded. But, in a larger sense, as embracing not only beneficial effects upon the channel, but as a protection against destructive floods, a levee system is essential; and such system also promotes and facilitates commerce, trade, and the postal service."

The plan of improvement recommended is based upon the fact that the bad navigation of the river is produced by the caving and erosion of its banks and the excessive widths and the bars and shoals resulting directly therefrom. The work to be done, therefore, is to scour out and maintain a channel through the shoals and bars existing in those portions of the river where the width is excessive, and to build up new banks and develop new shore lines, so as to establish as far as practicable the requisite conditions of uniform velocity for all stages of the river. It is believed by the commission that this improvement can be accomplished below Cairo by contracting the low water channel way to an approximately uniform width of about 3,000 feet for the purpose of scouring out a channel through the shoals and bars, and by causing, through the action of appropriate works constructed at suitable localities, the deposition of sand and other earthy materials transported by water upon the dry bars and other portions of the present bed not embraced within the limits of the proposed low water channel. The ultimate effect sought to be produced by such deposits is a comparative uniformity in the width of the high water channel of the river. It is believed that the works estimated for in the report will create and establish a depth of at least ten feet at extreme low stages of the river over all the bars below Cairo, where they are located. It is also the opinion of the commission that, as a general rule, the channel should be fixed and maintained in its present location, and that no attempts should be made to straighten the river or to shorten it by cut-offs.

THE medicinal rule is that an elevation of 4,000 feet above the level of the sea confers immunity from yellow fever.

FLOWERS AND THE WEATHER.

The vegetable kingdom opens up a curious field of investigation, in which the meteorologist will learn much regarding the mutual interdependence of all departments of creation. If light and electricity be, as well known, influential in exciting the movements of animals breathing the vital air, plants are equally subject to the same potent agencies, and testify to their influence so visibly as to attract the notice alike of the scientific botanist and of the illiterate rustic. In some parts of England the peasants mark the blooming of the large water lily, and think that the number of its blossoms on a stem indicates the price of wheat per bushel for the ensuing year—each blossom being equivalent to a shilling. We smile at this as superstitious folly; but even philosophers have not deigned to despise the weather indications afforded by the shutting of the flowers of certain plants.

Lord Bacon, for example, who was remarkably attentive to all the appearances and changes of natural objects, is the author of some of the observations which follow:

The Pimpernel (*Anagallis arvensis*).—"When the flower of this plant," says Bacon, "expands boldly and fully, no rain will happen for four hours or upward; if it continues in that open state, no rain will disturb the summer's day; when it half conceals its miniature flower, the day is generally showery; but if it entirely shuts up or veils the flower with its green mantle, let the traveler put on his great-coat, and the plowman, with his beasts of draught, expects rest from his labor." This little plant, from its peculiar susceptibility, has long been known as the "Poor Man's Weather Glass."

"The Siberian sow thistle (*Sonchus*).—If the flowers of this plant keep open all night, rain will certainly fall the next day."

"The African marigold (*Tagetes erecta*).—If this plant opens not its flowers in the morning about seven o'clock, you may be sure it will rain that day unless it thunders."

"The trefoil (*Hedysarum*).—The different species of trefoil always contract their leaves at the approach of a storm; hence these plants have been termed the 'Husbandman's Barometer.'"

"White thorns and dog rose bushes.—Wet summers are generally attended with an uncommon quantity of seeds on these shrubs, whence their unusual fruitfulness is a sign of severe winter."

Besides the above there are several plants, especially those with compound yellow flowers, which nod, and during the whole day turn their flowers toward the sun. Such flowers are designated as "heliotropes," and the movement which they thus exhibit is called their "nutation." This is particularly observable in the common sow thistle (*Sonchus arvensis*); and it is a well known fact that a great part of the plants in a serene sky expand their flowers, but before rain they shut them up, as the tulip, for instance. The flowers of chick-wintergreen (*Trientalis Americana*) droop in the night, lest rain or moisture should injure the fertilizing pollen. One species of wood sorrel (*Oxalis*) shuts up or doubles its leaves before storms and tempests, but in a serene sky expands or unfolds them, so that husbandmen can foretell tempests from it. It is also well known that the sensitive plants and other species of *Cassia* observe the same rule. The flowers of the bindweed (*Convolvulus arvensis*), the wood anemone, and the common daisy (*Bellis*), even if already open, will shut up on the approach of rain. The last named flower appears to have derived its name—day's eye—from its sensitiveness to light. Such phenomena as these are probably determined by the action of light; and the flowers of such plants being shut at ten or eleven o'clock in the morning tell of clouds and gloom, and so predict rain.

Besides affording prognostics, many plants also fold themselves up at particular hours, with such regularity as to have acquired particular names from this property. Linnæus has enumerated forty-six flowers which possess this kind of sensibility. From an arrangement of such flowers it has been ingeniously proposed to form a floral timepiece. The flowers of the goat's beard (*Tragopogon*) open in the morning at the approach of the sun, and, regardless of the weather, shut about noon, and hence its common name of "go-to-bed-at-noon." The star of Bethlehem expands its flowers about eleven, and closes them at three in the afternoon. The evening primrose (*Œnothera*) is well known from its remarkable properties of regularly shutting with a loud popping noise about sunrise and opening at sunset. After six o'clock, these flowers regularly report the approach of night. The flowers of the garden lettuce open at seven o'clock and shut at ten. That light is the chief agent of these changes seems to be proved by the experiments of De Candolle, made at the Jardin des Plantes, in an underground cellar, illuminated by lamps giving a light equal to fifty-four ordinary wax candles. By lighting these he could cause the flowers of the star of Bethlehem to open at pleasure, and also those of the sea camomile, which keeps its flowers closely shut during the night; but he could produce no artificial effect with the strongest light upon several species of wood sorrel, whose flowers and leaves are both folded up at night. With the sensitive plant he succeeded in so completely changing the hour of closure that on the third day from being placed in the lighted cellar it began to fold its leaves in the morning and open them in the evening. One of the most singular cases of the action of light on plants is that of the *Lotus* of the Euphrates, as described by Theophrastus, and which he represents as rearing and expanding its blossom by day, closing and sinking beneath the surface of the water by night, so as to be beyond the grasp of the hand, and again rising up in the morning to present its expanded blossom to the sun. The same phenomenon is also related by Pliny

"Sheep Rot."

For some time a great mortality has prevailed among sheep, and the destruction reported is something appalling. The malady is popularly known by a very old Saxon name, "rot," and is in reality due to the presence in the liver and hepatic canals of numbers of the *Distoma hepaticum*, a trematode entozoon, as well as the *Distoma lanceolatum*, also a member of the same order. These entozoa, from their resemblance to the fish called "flukes," have received the same name, and have a particular predilection for the biliary apparatus, whose function they more or less destroy, and thus lead to the slow death of the sheep or other animals they may infest. After wet seasons, animals which have been pastured on tainted land are certain to suffer, from their having ingested with the herbage the ova of the Distoma. Pastures are tainted by "fluke" infested sheep, which pass the mature worms or their ova with the fæces, and these lodge on or are washed into the ground. The worms, of course, die, and the ova within them are liberated; and these, together with the free ova, appear to have not only a strong vital resistance to meteorological alternations, but also the good fortune to find a ready and acceptable intermediary host in the *Limnæus minutus*, a little mud snail common everywhere, and particularly on wet land. This snail becomes possessed of a number of ova in its interior, and during damp weather it crawls from its breeding place in the ground up the stalks of grass and herbage, and is swallowed by the sheep or other herbivorous animals when they are grazing. Received at first into the stomach, the ova undergo partial development, and then find their way into the biliary canals. If their number is considerable, when they have attained their full growth they dilate and obstruct these canals, the walls of which become considerably thickened. During their development the secretion of bile becomes gradually diminished, and that fluid is viscid, like mucus, and altered in color; at the same time the parenchyma of the liver becomes atrophied from the compression the "flukes" exercise upon it, and it may even become disorganized. Hence result icterus, disturbance in nutrition, anæmia, dropsy, and a general cachectic condition.

Sheep are not the only victims which suffer from the Distoma, for during the present mortality hares, rabbits, deer, and horses are said to have become infested, and died. The *Distoma hepaticum* has long been known to exist in the horse and ass, when they were allowed to pasture on unclean land during wet seasons.

Salt appears to be an excellent and well known prophylactic agent, and even a curative one when the disease has not made much progress. This beneficial action of sodium chloride has been known almost from time immemorial, and the freedom from "rot" of sheep which have been pastured on salt marshes has been also recognized for centuries.

The flesh of sheep which have been affected with this verminous disease cannot be said to be positively dangerous as food, though it must be greatly reduced in nutritive properties, as well as in quality. The human being may receive and harbor the Distoma, a fact worthy of remembrance. The present mortality is likely to render sheep scarce and expensive in this country for some time, and still further darken the prospects of our agriculturists.—*Lancet.*

A Deep Well.

The Continental Diamond Rock Boring Company, Limited, have lately completed for the Government of Mecklenburg-Schwerin a bore hole of exceptional depth, and the execution of which is of particular interest from the rapidity with which it has been completed. The boring, which was made for salt, is situated at Probst Jesar, near Lubtheen, and it was commenced on the 6th of July of last year, with an opening 12 inches in diameter. The first part of the bore had to be through a diluvial bed consisting mainly of drift sand and coarse gravel, and for sinking through this Kohrich's system was adopted, the diameter of the bore being maintained at 12 inches. The total depth sunk on this system was 98·05 meters, or 321 feet 8 inches, the sinking occupying 34 days of 24 hours each, of which 31 days were spent in actual boring and three days in sundry works. The average progress was thus at the rate of 3·163 meters per day, while the greatest depth bored in any one day was 7·496 meters, this being on August 11, 1879.

Below the diluvium the gypsum and rock were reached, and through this the boring was carried on with diamonds, the commencement being made on August 25, 1879, with a hole 10½ inches in diameter. Until a depth of 509 meters, or 1,670 feet, had been reached, however, no firm footing could be obtained on which to rest the tubing, and hence great annoyance was experienced from the falling in of masses of sand, the infalls being so great that sometimes when the boring rod was withdrawn the bore became filled up again to a depth of over 420 feet. The boring, however, was steadily proceeded with, and ultimately the final depth of 1207·25 meters, or 3,961 feet, was attained on the 6th of February last, the diameter of the bore at the bottom being 3 inches. The time spent in boring with diamonds was 168 days of 24 working hours.

The greatest progress made in any one day was on the 27th of January last, when a depth of 29 meters (95 feet 2 inches) was bored, this being nearly double the average progress. The total length of tube inserted was 1010·55 inches, or 3,315½ feet, the greatest length inserted in one piece being 456·424 meters, or 1,497½ feet, and this consisting of 7 inch and 8 inch tubes. Throughout the whole depth of the bore cores were drawn, some of these being salt cores over 2 feet long in one piece.

With the exception of a bore hole put down to the depth of 1,275 meters, or 4,183 feet, for the Prussian Government, a few years ago, and which took four years to accomplish, the bore of which we have been giving particulars is we believe the deepest yet sunk, and the fact that it was completed in less than six months speaks well for the skill and energy with which the work was carried out.

A Plan to Utilize Genesee Falls.

The Rochester *Democrat and Chronicle* of April 3 gives the following description of the Rochester Hydraulic Motor Company's plan for utilizing the water power of Genesee Falls:

The derrick, which is a miniature model of the one to be erected at the lower falls, stands in a room with the miniature machinery and airomotor. Water passes through small pipes and tubes into a flume at the upper part of the derrick, and has precisely the same effect, only in a smaller degree, as would the force of the falling waters of the Genesee exert in a proportionately gigantic flume. In the two perfectly gated compartments of the flume there are two metal siphons. By the time the gate has permitted sufficient flow of water to submerge the top of the siphon on either side the flow is stopped, and as soon as the water reaches the siphon's top the entire quantity within the reservoir discharges itself through the pipe of the siphon into another hydraulic process below. The two flume gates and siphons act alternately, and the double action progresses like clockwork. The water through the siphon pipe goes down into an air receptacle, the fall being five feet in the model, but twenty times as great in the motor itself, as designed to be erected, and as the five foot fall constitutes the amount of hydraulic pressure contained in the model, the proportionate force of the motor may be faintly imagined while noting the work of the small affair. Passing into the two air receptacles or cylinders (which lie in the water trough representing the river bed) the water surges down and compresses the air, which has already been admitted ahead of it into the cylinders. The water forces the volume of air forward into a drum, through another automatic closing valve. From the drum the air goes into the final air reservoir, where it remains compressed for use, and from whence it may be drawn off or distributed through the pipes to any desired point, for various uses. Even with this miniature model the air generated is very powerful, and will lift a heavy man right off the floor.

The original design of the inventor was to utilize the cataract of Niagara for running the machinery of Buffalo; but the falls and the city were too widely removed for this to be practicable at an expense of less than $2,000,000, so that Rochester was chosen as the ground for the test, and the lower falls of the Genesee as the water power. The derrick for the motor will be erected on the east side of the falls, where there is a natural cove in the rock for the works below. The frame of the derrick will be 125 feet high, rising slightly above the edge of the falls and about 25 feet from it. The dam already placed across part of the falls directs the water to a 16 foot bulkhead, and is bolted to the solid rock with 5,000 pounds of bolts. The water going through the bulkhead enters the flume and the reservoirs and siphons in the derrick. The siphons will be nearly 100 feet long, and the air receptacles or cylinders in the river bed (four in number) will each be 500 feet long and 6 feet in diameter. The company intend to erect a suspension bridge running from the west side of the falls to the derrick. The dam was built last fall when the water was low, and work upon the rest of the machinery will be commenced as soon as the weather permits. To state it briefly, the objects to which the company propose to devote this enormous and exhaustless power are these: To supply the city of Rochester and vicinity with a motor (in lieu of steam) for mechanical and manufacturing purposes—a motor capable of working every and all portions of the machinery in the city, with force enough reserved to supply compressed air and run all our street cars, unaided by any other propelling power. Also, "to supply the city with a light (in lieu of gas) cheaper, brighter, softer, and safer than the Edison horseshoe light." In this connection mention may be made of the fact that the company already produces a light which meets the description given—and where it costs a dollar a foot to generate gas, this light can be generated for a cent a foot.

In conclusion it may be added that the Motor Company has already made partial arrangements with the street railway company, so that at the works of the former at the lower falls the air cylinders to be put upon each car can be filled, in a few seconds, with enough compressed air to run them sixteen miles. The tracks of the Rochester City and Brighton Railroad Company are already laid to the site of the company's works, so that the cars can be supplied without any additional expense in this respect. The new power can be supplied at less than one-tenth the present cost of horse power, and yet allow a very liberal margin of profit to the motor shareholders.

A CHEAP black varnish for polished iron and steel, and which is said to be very good, is made with ten parts of oil of tar and one part of sulphur. This mixture, of a deep brown color, is applied with a fine hair brush, and then let to dry at a gas flame until the varnish becomes quite black.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

NEW BOOKS AND PUBLICATIONS.

AROUND THE WORLD WITH GENERAL GRANT. By J. Russell Young. American News Company, Publishers, New York.

Parts nineteen and twenty of this very interesting narrative of General Grant's tour around the world are just out, which complete the series. The author, Mr. Young, accompanied the General and his family throughout their travels, and he has given in these numbers a most interesting account of the places they visited, the curious customs of the people, and the regal manner in which the party were received and entertained by the kings and queens and other official dignitaries of the many countries they visited. The entire work contains some 650 pages, and embraces 800 well executed engravings of the most interesting places visited by the General and his party, and the most curious and wonderful objects they saw during their extended journeyings.

SMITHSONIAN INSTITUTION. BUREAU OF ETHNOLOGY. INTRODUCTION TO THE STUDY OF SIGN LANGUAGE AMONG THE NORTH AMERICAN INDIANS, AS ILLUSTRATING THE GESTURE SPEECH OF MANKIND. By Garrick Mallery, Brevet Lieut. Col. U. S. Army. Quarto, paper, pp. 72. Washington: Government Printing Office. 1880.

An exceedingly important paper, intended at once to indicate the scope and purpose of a work upon sign language in preparation by the Bureau of Ethnology of the Smithsonian Institution, and to call out interest and correspondence upon the subject. It gives, in the form of a vocabulary, a collation of all authentic signs, with descriptions of them, and of specially associated facial expressions, with engraved illustrations when necessary; also brief considerations of the practical value of sign language, the syntax of signs, origin and extent of gesture speech, modern uses of gestures and signs, etc.

MODERN OBSERVATIONS ON RIFLE SHOOTING, WITH AN IMPROVED SYSTEM OF SCORE BOOK. By Edwin A. Perry. New York: E. Remington & Sons. Pocket book form. Leather, pp. 129. Price $1.

This is the third edition, with additions, of Captain Perry's "Green Book," so widely and favorably known to long range riflemen. The additions embrace an article on long range with military rifles, and one on the long range tournament of last year, tabulating the results, and drawing from them such conclusions as the most advanced science of rifle practice seems to warrant. The book is all but indispensable to all who take a practical interest in the science and art of long range rifle shooting.

ENGINEER'S AND MECHANIC'S POCKET BOOK. REVISED AND ENLARGED. By Charles H. Haswell. New York: Harper & Brothers.

There are few intelligent mechanics and fewer engineers in the United States who need to be told of the existence and practical usefulness of "Haswell." The new edition—the thirty-sixth in number—has compressed within its 673 pages a marvelous amount of exact information, largely in the form of tables, formulæ and condensed statements of facts, carefully classified and well indexed. As a convenient reference book for the general reader it is scarcely less useful than for working mechanics and engineers.

THE SLIDE VALVE PRACTICALLY EXPLAINED. By Joshua Rose, M.E. Philadelphia: Henry Carey Baird & Co. Cl., pp. 100. Price $1.

Offers to practical men a clear explanation of the operations of each element in a slide valve movement, the effects of variations in their proportions being illustrated by numerous examples from recent successful practice. Thirty-five engravings.

PRACTICAL KERAMICS FOR STUDENTS. By C. A. Janvier. New York: Henry Holt & Co. 12mo, cl., pp. 258. Price $2.50.

The author has brought together, chiefly from authorities not easily accessible to students, a large amount of practical information touching the history, composition, manufacture, and decoration of all sorts of pottery, by which term is included all terra cottas, earthenwares, stoneware, and porcelains. The matter is well chosen, concisely put, and admirably arranged. The book is well made and amply indexed.

BRAIN AND MIND; OR, MENTAL SCIENCE CONSIDERED IN ACCORDANCE WITH THE PRINCIPLES OF PHRENOLOGY AND IN RELATION TO MODERN PHYSIOLOGY. By Henry S. Drayton, A.M., and James McNeill. Illustrated. Cloth, 12mo, pp. 384. Price $1.50. New York: S. R. Wells & Co.

The authors have given with considerable ability a review of the system of mental science known as phrenology, with the relations of mind to anatomy and physiology as understood by phrenologists. The book contains a large number of engraved illustrations of that peculiar sort characteristic of works on phrenology.

VACCINATION TRACTS. London: William Young. 16mo, cl., pp. 320.

This volume comprises 1 to 14 of the anti-vaccination tracts, issued apparently by or for the Anti-Vaccination Society of England. They are made up chiefly of excerpts from all sorts of writings "scattered in pamphlets, newspapers, and other periodicals." Our opinion of the movement has already been given in this paper; and so likewise have the arguments of its friends.

THE FRUIT GROWERS' FRIEND: AN EASY GUIDE FOR THE RAISING OF FRUITS FOR PLEASURE OR PROFIT. By R. H. Haines. New York: American News Company. 8vo, paper, pp. 34. Price 30 cents.

A practical manual, arranged for ready reference, giving the newest and most successful ways of growing large and small fruits.

SPONS' ENCYCLOPÆDIA OF THE INDUSTRIAL ARTS, MANUFACTURES, AND COMMERCIAL PRODUCTS. Part 11. Treats of Coal Tar Products, Cocoa, and Coffee. 64 pp. Price 75 cents.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. H. K. asks if a blow pipe is operated by a force pump having a metal condensing chamber, will it blow a steadier stream, and also stronger, if the condenser is made of elastic rubber? A. An elastic chamber is unnecessary. The air itself is sufficiently elastic to cause a ready flow.

(2) J. L. asks: If a boiler has two safety valves, namely, two inches and three inches, and both weighted alike (half inch), which would blow off first, and why? A. The three inch valve would probably lift a little in advance of the other, as there is less proportionate friction.

(3) L. W. D. asks: What is the best material for filling the space between inside and outside boards of a refrigerator? A. Sawdust is generally used and answers a good purpose as long as it is kept dry. A simple air space is effective if the walls are perfectly air tight.

(4) H. A. S. asks: Which is the cheapest boiler that can be made to run an engine 4 inches stroke by 6 inches bore? Can one be made out of common gas pipe so as to run an engine of that size? A. Yes; make one out of gas pipe not less than two inches diameter.

(5) A. V. asks if there is any means of removing stumps other than by the use of machinery. A. The following has been recommended: In the top of the stump a number of holes, each capable of holding a pound or two of saltpeter (potassic nitrate), are bored, filled with the salt, and during the latter part of the fall kept full of water, which will dissolve the salt, and the solution formed gradually passes into the roots. In the early spring the same holes are to be filled for a week or two with kerosene oil, and finally the oil soaked stump set fire to, when the combustion will proceed, aided by the oxygen of the niter, until the greater part of the roots are consumed, after the manner of a slow match.

(6) R. E. G. asks: Is there any way of drilling a small hole in glass? I wish to suspend a pane of glass by means of a thread or fine string. I have broken a large amount of glass in trying to bore a small hole in it, but have not succeeded. A. Use turpentine, and take care when the drill is about to break its way through the glass as the hole is finished.

(7) E. B. asks: How are glass water gauges cut off to proper lengths without breaking? A. One method employed by mechanics is to break off the end of a round file, say 1/4 inch, so as to obtain a sharp edge, then with it scratch a circle on the inside of the gauge, at the proper length, and it will readily snap off where the scratch is made. Another method is to file a nick in one side and place the thumbs opposite the nick and break the glass as a stick would be broken.

(8) A. & P. ask how to make a good tooth wash. A. Take sugar of milk 100 parts, pure tannin 15 parts, lake 10 parts, oils of mint, anise-seed, and orange flowers, sufficient quantity. Rub together the lake and tannin, gradually add the sugar of milk, and then the oils.

(9) T. L. C. asks how to make common polish boot blacking? A. Ivory black 1 part, molasses one half part, sweet oil one-eighth part. Mix and stir in hydrochloric acid one-eighth part, and oil of vitriol one-fourth part. Dilute the acid with twice its weight of water before mixing. Another recipe is to take ivory black 4 lb., molasses 3 lb., sweet oil 1 lb., oil of vitriol 1 lb. Mix and put in boxes.

(10) C. U. B. writes: I am building a flat bottomed, stern wheeled boat, 60 feet long and 10 feet beam at the water line, drawing 18 inches. What horse power engines would be required to run her? A. Two engines 10 inch cylinder and 2 feet stroke. 2. Could I not use a central crank, and dispense with one engine? A. Yes, but your one engine must be equal in capacity to the two 10 inch by 2 feet stroke.

(11) A. G. writes: Cambridge Physics, article Philosophy, by Rolf & Gillet, says, page 143: "But very few substances expand when they become solid. Iron is such a substance, and it is owing to this property that it is so well adapted for castings. As it solidifies, it expands so as to completely fill the mould." If this is so why do pattern makers always make their patterns one-eighth of an inch on a foot larger than the casting required? A. The volume of iron in a molten state is less than when it is crystallized or solidified. It solidifies at a very high temperature, when it perfectly fills the mould. During the subsequent cooling it shrinks so that it becomes, when cold, smaller than the mould or pattern.

(12) E. L. M. asks: 1. In what numbers of the SUPPLEMENT can directions for making a Bell telephone be found? A. SUPPLEMENT 142 contains the information you desire. 2. Will it work without battery, through No. 17 iron wire, over a distance of 300 or 400 feet? A. Yes.

(13) S. E. J. asks why the axles and boxes to wagons, etc., are made on a taper, or smaller on the outer end than on the inside end of bearing, and would the axle being straight or crooked make any difference. I notice that all the builders make them in that way. What is the reason for it? A. All axles are not made with taper; when so made, the axles are set or bent so that the underside or wearing side of the axle is at right angle to the "dish" of the wheels. Axles are made tapering to facilitate the removal of the wheel. This would sometimes be very difficult were the axle made straight.

(14) O. R. L. writes: 1. In the SCIENTIFIC AMERICAN of October 11, 1879, you have a cut of the steamer Polliwog, dimensions as follows: Length 25 feet, beam 12, draught 3 1/2, boiler 15 horse power. With the hydromotor which is represented in her you say she will make six knots per hour, and that the engine will give to the boat 40 per cent of the power generated. Now what I wish to know is at what rate per hour would the most advantageous form of engine and screw propel this same boat? A. 10 to 12 miles per hour, depending on model. 2. What percentage of the power generated would be given to the boat? A. 50 to 60 per cent, according to the size and proportions of the screw.

(15) H. H. M. writes: In SCIENTIFIC AMERICAN of March 6, page 150, is an article on etching on glass with diluted fluoric acid. Will you please inform me how to dilute fluoric acid, or what to dilute with, and the proportion? A. Dilute the fluoric acid with water.

(16) J. M. asks (1) for the proportions for making rubber waterproof solution. How much rubber, how much bisulphide of carbon, and how much absolute alcohol? A. Caoutchouc (gum rubber) 1 oz., carbon disulphide, about ½ pint rubber, and vice versa. 2. If you drop coal oil on a hot plate it will vaporize. Is that the same as gas; if not, what is the difference between vapor and gas? Will the vapor condense back into liquid, or how will you keep it in a state of vapor? A. A gas is distinguishable from a vapor by the fact that as in the case of atmospheric air, it can only be condensed by great cold and pressure. The vapor of coal oil or petroleum is not such a gas. If, however, this vapor be brought into contact with intensely heated surfaces a considerable portion of it is converted into a gas as permanent as that used for illuminating purposes. It is used by some of our gas companies for enriching common coal and "water gas." Alone it burns with a very smoky flame, owing to its richness in carbon.

(17) R. D. asks: What is peroxide of manganese composed of, and where can I obtain such as is used for filling the porous cup of a Leclanche battery? A. It is a compound of the metal manganese with oxygen. It occurs native as pyrolusite. It can be obtained through any druggist. 2. How is hard rubber moulded such as is used by electricians? I can get this rubber in sheets any thickness, and I want to know if I can melt it and run it into any form I wish. A. It cannot be melted or moulded as you propose. See pp. 41 and 105, Vol 39, SCIENTIFIC AMERICAN.

(18) H. D. C. asks for a recipe of rubber cement that will cement together the edges or overlaps of thin sheet rubber. A. The rubber cement is prepared by dissolving finely cut pure gum caoutchouc in a sufficient quantity of naphtha. The naphtha is warmed by standing the vessel containing it in another containing hot water, away from fire.

(19) H. M. asks: What dye is strong enough and cheap enough to use as a test of suspected communication between a cesspool and a well? Can you suggest any better method than the use of a dye to learn if any communication does exist between the cesspool or well? A. The coal tar dyes magenta and fluoresceine have been employed successfully for similar purposes.

(20) G. W. H. asks how to make a good cement for wood with a light color. A. Dissolve best white glue in a sufficient quantity of strong hot acetic acid.

(21) J. H. F. asks: Do you know of any method whereby gray iron castings can be coated with brass to a thickness of one-sixteenth or more of an inch? A. We know of no better way than that of brazing on a shell of the requisite thickness.

(22) W. L. asks where to find information in regard to the distillation of turpentine and rosin. A. Consult Knight's New Am. Mech. Dictionary, also Johnson's and Appletons' Encyclopædias. We know of no book on the subject.

(23) E. H. K. asks: What work on assaying could you recommend to me? Or is there anything in your paper that would give satisfactory information on metallurgy? A. Consult Percy's Metallurgy and Rickett's "Assaying and Assay Schemes."

(24) D. H. C. asks for the name or names of some complete and reliable book or work on assaying gold and silver, etc., from all kinds of quartz and rock and ore. I want some complete work on the above giving full details of the latest and best methods, giving materials, etc., used; name of book, price, address where to be had. A. See reply to E. H. K., this page. You should address booksellers who advertise in this paper for their catalogues and price lists.

(25) F. B. W. asks if Richard Trevithick, of Merthyr Tydvil, South Wales, ran an engine on rails before an engine was run on the Stockton and Darlington road, England. A. Yes, in 1805, in South Wales.

(26) A. M. R. asks: What is the composition of the gelatine transfer pad? A. See p. 293, Vol. 41, SCIENTIFIC AMERICAN.

(27) A. D. writes: I am desirous of using vulcanized India rubber for moulding purposes. Will you tell me the best method of reducing rubber to the proper consistency for that purpose, and if anything is required to harden it again? A. Vulcanized rubber cannot be reworked in the way you propose. See pp. 41 and 105, Vol. 39, SCIENTIFIC AMERICAN.

(28) C. W. V. writes: In your issue for February 28, 1880, Vol. 42, page 133, you give a receipt for guttapercha cement. What kind of pitch do you mean; that made from coal or that made from the pine tree? A. Pine pitch. The addition of shellac will harden it.

(29) S. L. H. asks for a receipt for making a solution to be used as sizing on white paper so as to prepare it for varnishing with alcohol varnish. A. Have you tried thin aqueous solution of glue?

(30) H. T. writes: 1. A piece of floor oilcloth has been laid and in use several months and still remains sticky to such a degree that chairs, tables, etc., placed upon it will adhere to it more or less. What is the cause, and how can it be remedied? A. Try the application of a moderately strong wash of acetate of lead in hot water. 2. By what process can the polish of black marble, such as cases of French clocks are often made of, be restored after having become dull by age or handling? A. Use fine moist rouge and chamois skin. 3. I have a piano of excellent quality in every way except that it will not remain in tune longer than about one week after tuning, owing, as I believe, to the tuning pins being too small or thin for their sockets. Can I remedy this defect by the application of any such substance as glue or rosin or anything of that nature to the pins or sockets; if so, which is the best, and how should it be applied to obtain the best result? A. Get a new set of tuning pins of large diameter. 4. In our climate the felt with which the dampers and hammers of pianos are covered is generally damaged materially within a short time by moths. Could not this felt, before application, be impregnated with some chemical that would prevent the attack of the moths and that would not at same time produce deleterious effects upon the glue with which the felt is fastened to the hammers, or upon the strings where they are struck or touched by it? A. A little camphor sprayed on in alcoholic (absolute) solution does very well.

(31) J. R. C. asks how to remove castor oil and balsam fir from a camel's hair brush. A. Use oil of turpentine or ether.

(32) H. B. G. writes: In the *Science Record* of 1874, page 20, is a recipe for destroying hair. One of the ingredients is sulphhydrate of sodium. Now, is there another or common name for it, for I have been to every druggist in this vicinity; some say that they do not know what it is; others say that there is no such thing. A. Use ordinary chemically pure sulphide of soda (sodium sulphide), sold by dealers in laboratory supplies.

(33) W. P. writes: I have spilled a lamp full of coal oil on a Brussels carpet. How can I remove the spot or stain? A. Spread over the spot, above and beneath, warm pipe clay, and allow it to remain 24 hours; then brush it off and beat out the adhering portions with a light switch.

(34) L. F. asks: 1. What advantage is it in the gravity battery to have the copper on the bottom instead of having it suspended from a yoke? A. It is so placed because the cupreous solution is strongest at that point, and as a matter of convenience. 2. If you silverplate first with a striking solution and strong battery, why do you not finish with the same also; or what advantage is there to use a richer solution and weaker battery? A. A weak bath and strong battery, because a strong bath or long exposure in a weak one is apt to act upon the uncoated metal and render the deposit uneven; a weak current and stronger bath, because such a current produces a more regular and "freer" coating, and such a bath has less resistance and requires a smaller exposure of anodes and less attention. 3. Your receipts for striking solutions have to 1 gallon of water from ¼ oz. of AgCy, Vol. 40, page 124, 4; and 3 oz., Vol. 44, page 50, 4; and from 1 lb. of KCy, Vol. 46, page 124, 4; to 2½ lb. of KCy, Vol. 42, page 50, 4. A. As a rule, the former gives the best results, especially with the more positive metals; the latter works more rapidly and quite satisfactorily with copper and German silver, if the battery is rapid enough and the work properly trussed.

(35) S. E. T. writes: I am using water from a well at the bottom of which there is quicksand. The suction pipe is two or three feet from the bottom, yet there seems to be a sort of fine mud or sand-like deposit around and on the water gauges. I blow out about a foot of water from the boiler every other day. The water which comes out is clear and free from a deposit. I do not see why there should be an apparent deposit around and from the water gauges and still the water seem so clear. Can you help the difficulty by any explanation? Do you think there is any great amount of deposit or scale-forming material collecting on the interior of the boiler? When we are running the planer the water in the boiler seems to rise up or foam. Is there any remedy for it? A. The water should be first pumped into a settling tank and drawn from that to deliver to the boiler; two settling tanks used alternately will be necessary, except one tank be large enough for a day's work, and is filled in the evening, and the water allowed to settle through the night. We can give no opinion about the scale forming, without knowing the character of the water. The foaming may proceed from bad water, bad circulation, or scant steam room. The residue consists chiefly of a very fine, light silicious clay and lime.

(36) A. F. O. writes: In pouring the composition for my gelatin printing pad I am troubled with little bubbles, which leave troublesome depressions. How can they be avoided? A. Warm the vessel in which the composition is to be poured, and skim the surface by drawing a sharp edged piece of metal or cardboard over it immediately after pouring.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

F. L. S.—It is micaceous hematite. Its precise value here could only be ascertained by an analysis. Distance from railroad or navigable route, etc., must also be taken into consideration.—H. W. B.—It is chalcopyrite, an ore of copper—if found in sufficient quantity, of some value.—A. L. F.—1. Clay slate containing iron pyrites. 2 and 3. Porphyry. 4. Iron pyrites in altered dolerite.

COMMUNICATIONS RECEIVED.

On Mercury in Vulcanite Plates. By T. H. C.
On Ice boats. By T. D.
On the Power Used in Driving a Foot Lathe. By M.
On Ice Boats. By J. P. C.
Astronomical Notes. By W. R. B.
On Water Supply for Washington. By C. L. F.
On Repairing Spiral Springs. By E. N. M.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 13, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Adjustable chair, M. F. Bell 226,473
Anode frame, A. Van Winkle 226,076
Arm rest for writers, H. H. McElroy 226,611
Artist's canvas stretcher, J. G. Fletcher 226,329
Auger, earth, D. P. Cadd 226,444
Automatic gate, J. P. Kelso 226,323
Axle box cover, car, A. R. Tiffany 226,463
Axle box, locomotive, J. J. Thomas 226,571
Axle, vehicle, W. C. Partlow 226,434
Bale tie, J. R. Cavett 226,397
Baling bran, etc., machine for, H. Kennedy 226,325
Barrel bodies, heating apparatus for, Wood & Wilkison 226,425
Barrel swing, P. W. Nelson 226,339
Bell fastener, W. L. Potter 226,346
Billiard table, J. Walsh 226,490
Boot and shoe, D. A. McDonald 226,380
Boot and shoe shank, Buren & Fenton 226,466
Boot and shoe, spring soled, T. Nuthmann 226,541
Boots, last or form for shaping rubber, I. W. Tufts 226,334
Box, D. Dunscomb 226,509
Bracelet, rubber, D. Stone 226,344
Brake lever, A. C. Fish 226,508
Brush, F. Sprower (r) 9,160
Brush holder, E. B. Randolph 226,551
Brush, mucilage, J. B. Davids 226,500
Buckwheat hulling machine, T. Nelson (r) 9,161
Butter package, S. M. Kohr 226,304
Butter, preservation of, T. F. Wilkins 226,467
Button setting instrument, G. W. Prentice 226,349
Candlestick, W. Selkirk 226,556
Car coupling, B. F. Fairlie (r) 9,147
Car coupling, D. Frank 226,306
Car wheel, J. F. Kelly 226,453
Carburetor, M. S. Wright 226,581
Carpet sweeper, Gates & Potter 226,513
Carriage top, D. Conboy 226,300
Cheese cutter, W. B. Green 226,523
Chimney caps, etc., ventilator for, B. W. Felton 226,307
Cigars, putting up, J. Felbel 226,302
Clasp, C. C. Shelby 226,334
Clock, electric, J. Happersberger 226,401
Cloth, etc., machine for cutting, H. Stein 226,477
Clothes line adjuster, F. Bonaventure 226,344
Coffee pot, C. B. Veronee 226,465
Coin holding and delivering apparatus, A. S. Tyler 226,575
Coin holding and delivering device, J. O. Hands 226,514
Composition of matter, J. L. Pope 226,547
Compound engine, K. W. Jurisch et al. 226,425
Compound engine, L. Perkins 226,418
Cornice, window, B. W. Kerfoot 226,406
Cracker machine, C. L. Vale (r) 9,151
Cradle and carriage, combined, H. S. Prayn 226,456
Cultivator fender, L. Davis, Jr. 226,301
Cultivator tooth, E. R. McCall 226,385
Cutter head, G. W. Amesbury 226,392
Dashes, device for making, Peters & Standish 226,417
Draught bar, vehicle, H. Livingston 226,407
Dredging apparatus, W. H. Seward 226,327
Drilling machine, temple roller, N. Chapman 226,491
Electric machine, dynamo, J. E. Braunsdorf 226,400
Elevator safety attachment, Bissell & Littlefield 226,479
Engines, automatic apparatus for stopping, Ripp & Mueller 226,558
Evaporator, A. L. & A. S. Folger 226,306
Exercising machine, J. Arnett 226,486
Fan, M. Rubin (r) 9,154
Fence and fence post, wire, Boyer & Kinsey 226,396
Fence, portable, M. Higbee 226,403
Fibers from textile plants, extracting, P. A. A. M. A. Favier 226,306
Filing and binding papers, device for, I. W. Heysinger 226,402
Firearm, breech-loading, G. H. Fay 226,305
Firearm, magazine, N. King (r) 9,157
Firearm trigger, G. Schalck 226,565
Fire escape, H. Fuller 226,449
Fire kindlers, machine for making, A. F. Temple 226,569
Fish, preparing and preserving, D. W. Davis 226,390
Floors, walls, etc., covering for, G. P. Chiles 226,440
Flour bin and sifter, combined, J. M. Clark 226,441
Fluid motors, valve gear for, W. F. Class 226,494
Foul air trap for wash basins, J. L. Hutchinson 226,319
Fountain, J. Storer 226,429
Fulling mill, R. Eickemeyer (r) 9,146
Gas, generator for producing carbureted water, J. D. Averell 226,473
Gas governor, L. P. Blair 226,479
Gas, process and apparatus for manufacturing, M. S. Frost 226,307
Gem setting, V. Draper (r) 9,154
Glucose, manufacturing, C. Furbish 226,310
Glucose, manufacturing, J. F. Wolff 226,484
Grain, etc., apparatus for cleaning, J. Arbuckle 226,471
Grain drill fertilizing attachment, W. H. Young 226,409
Grain meter, G. A. Fry 226,511
Gum, chewing, T. Adams (r) 9,152
Harness, breast, C. M. Fouike 226,510
Harrow, F. F. Fuller 226,448
Harrow, D. L. Garver (r) 9,148
Harrow, G. Newton 226,414
Harrow, farm, A. O. Stiveson 226,563
Harvester brake, Jones & Pharis 226,451
Hat flanging machine, F. Law, Sr. 226,183
Hat pouncing machine, C. J. Sargent 226,354
Hat pressing machine, W. Foster 226,303
Hay unloader, F. Patrick 226,457
Hides and skins, softening, plumping, and depilating, J. Foley 226,447
Hoe hand, R. L. Turner 226,372
Hoisting apparatus, C. R. Albro (r) 9,153
Horse detacher, C. B. Sibert 226,349
Horses, apparatus for cleaning, M. J. Sunderlin 226,465
Horseshoe, J. M. Rouchel 226,422
Horseshoe calk sharpener, J. Low 226,408
Incubators, heat regulating device for, H. B. Tatham, Jr. 226,362
Interlocking switch and signal apparatus, A. G. Cummings 226,400
Iron, manufacture of, Hamilton & Griffith 226,450
Ironing board, G. H. Pearol 226,343
Label holder, H. Baker 226,474
Latch, automatic gate, Webb & Duncan 226,377
Lath bolter, Murray & Holt 226,337
Lawn rake, W. C. Quigley 226,419
Lightning rod coupling, S. C. Bacon (r) 9,163
Loom temples, burr roll for, Prouty & Sprague 226,548
Lubricator, T. M. Wilson 226,438
Magnet, electro, J. H. Bunnell 226,493
Magneto-electrical machine, A. K. Briggs 226,307
Measuring stick, shoemaker's, W. H. Varnum 226,429
Mechanical motor, J. G. Marcy 226,031
Mechanic's horse, J. F. Warner 226,401
Milk cooler, F. W. Moseley (r) 9,146
Nail forging machine, D. Armstrong 226,487
Packing for steam or water pipes, J. W. Cameron 226,387
Packing, piston rod, R. Shearer 226,328
Paper and cloth, coating, A. Sackett 226,456
Paper bag, W. Patterson 226,456
Paper bag machine, S. & M. Ruthenburg 226,428
Paper making machines, screen plate for, Pinder & Hardy 226,345
Papier mache, manufacturing articles in imitation of, S. Cunningham 226,497
Photo-relief engraving, G. C. Bell 226,392
Photograph burnisher, M. W. Jenks 226,521
Photographic stand and album, L. Dubernet 226,445
Photography, method and apparatus for coating plates for use in, G. Eastman 226,503
Piano action and action frame, C. F. T. Steinway 226,462
Picture and other frames, back for, L. A. Deather 226,301
Plow, Swartz & Arnot 226,567
Plow and cultivator handle, L. B. Morgan 226,340
Pocket, safety, M. A. Adler 226,470
Pop box, B. M. Williamson 226,381
Post office box door, W. H. Camp 226,449
Pressure regulator, W. Foster 226,304
Propeller, screw, J. B. Ward 226,436
Pump lever attachment, sand, J. Moloney 226,334
Reflector, lamp, F. R. Meyer 226,412
Rock drill, W. L. Neill 226,340
Rocking attachment to chairs, J. Reiche 226,420
Roofing fabrics, manufacture of, W. H. Stewart 226,461
Rotary engine, F. W. Link 226,327
Rubber or vulcanite, manufacture of hard, H., O., & M. Traun 226,372
Safety pin, A. M. Smith 226,460
Sash holder, B. C. Ryan 226,468
Sash lock, E. C. Ryam 226,427
Saw teeth blanks, manufacture of, D. Spaulding 226,436
Sewing machine, drag, A. J. Merritt 226,338
Scraper, rotary road, J. W. Wilson (r) 9,150
Screw bolt and nut, Ibbetson & Talbot 226,450
Seeder, broadcast, J. Hogan 226,516
Seeding machine, M. J. Clawson 226,442
Sewing machine hand power attachment, C. T. Christmas 226,442
Sewing machine motor, T. B. Marable 226,330
Sewing machine piping and hemming attachment, combined, G. W. Baker 226,392
Sewing machine, shoe, C. F. Bosworth 226,094
Sewing machine trimming attachment, J. R. Wilson 226,482
Sewing machines, mechanism for operating the feed and shuttles of, G. M. Pratt 226,350
Shingle machine, M. A. Bidwell 226,477
Shirt, E. S. Tomlinson 226,474
Shovel, spade, or fork, W. Chisholm 226,496
Sleigh, bob, W. Hughes 226,314
Slop jar or bucket, J. Solter 226,562
Sluiceway gate, T. Parker 226,455
Smoke stack, H. Brown 226,489
Soldering apparatus, J. J. Johnston 226,404
Sower, seed, W. S. Morgan 226,413
Spring coupling, H. S. Elder 226,446
Steam boiler, J. Cowhig 226,443
Steam boiler, portable, W. R. Michener (r) 9,149
Steam washer, D. & W. E. Richards 226,352
Stove, J. H. Irwin 226,530
Stove leg, adjustable, J. Mata 226,331
Suspender end, B. J. Greely (r) 9,155
Swing, J. W. Bowen 226,482
Telegraph conductor, underground, A. T. Woodward 226,408
Telephone call bell, H. C. Bliss 226,490
Telephone switch, E. N. Lord 226,328
Thermo-dynamic engine, E. Thuemmler 226,570
Thill coupling, E. P. Joslyn 226,452
Thill coupling, J. H. Wygant 226,438
Tobacco drying furnace, C. W. Hughes 226,517
Tobacco steaming apparatus, A. Harnish 226,515
Toy pistol, M. Backes 226,473
Trace splicing device, J. E. Card 226,496
Tray, waiter's, Lear & Connett 226,326
Tricycle, E. F. Esperandieu 226,504
Trimmings, manufacture of, R. Broseman 226,494
Tug, hame, J. Skidmore et al. 226,561
Valve, stop, G. H. Perkins et al. 226,544
Vehicle spring, C. M. Murch 226,436
Vehicle spring, N. Nilson 226,540
Vehicle spring bar, G. Newton 226,415
Velocipede, G. E. Whitmore 226,578
Vessels, construction of steam, A. Olsen 226,542
Vise for bench vises, pipe, F. I. Manis 226,410
Wagon, side bar, C. W. Saladee 226,424
Wagons and dumping them, device for unloading, P. H. Sammell 226,485
Wash stands, bath tubs, etc., combined valve and seal joint for, J. Besnor 226,476
Washing machine, T. Suppes 226,365
Waste pipes, etc., purifying and ventilating, B. Wilsdon 226,578
Water gauge, T. C. Purves 226,418
Whip rolling machine, C. M. Comstock 226,495
Windmill, J. A. J. B. Cushman 226,498
Windmill, G. Eischmuller 226,471
Wrench, J. W. Calef 226,440
Wrench, R. Miller 226,392
Wringer, H. A. Gore 226,310
Wringing machine, J. G. Roth (r) 9,158

DESIGNS.

Clock case, G. Havell 11,730
Coffin handles, Bailey & Brainard 11,728
Gimp, J. Graham 11,772
Handkerchief, J. Grimshaw .... 11,732 to 11,736
Newel post, J. I. Henley 11,736
Ornamental pin, A. Vester 11,735
Pen and pencil cases, barrels for, J. C. Aikin 11,732
Spoon or fork handle, C. T. Grosjean 11,729
Stocking fabric, ornamental, J. N. Hanifen 11,729
Umbrella handle, F. J. Kaldenberg .... 11,731 to 11,734

TRADE MARKS.

Beer, lager, Schmitt & Koehne 7,976
Cigars, cigarettes, and smoking and chewing tobacco, C. G. Emery 7,970
Galloons, doubles, Prussian bindings, braids, shoe laces, etc., R. Thorp & Sons 7,977
Guanos, superphosphates, and fertilizing compositions, R. W. L. Rasin & Co. 7,972, 7,973
Hats, felt, Crofut & Knapp 7,975
Scarfs for men's wear, made up, Fisk, Clark & Flagg 7,971
Soaps, S. W. Bell & Co. 7,974

English Patents Issued to Americans.

From April 9 to April 13, 1880, inclusive.

Boot nailing machinery, A. Knowlton, Boston, Mass.
Churn, W. Earle, Philadelphia, Pa.
Cocoanut oil, refining of, A. P. Ashbourne, Boston, Mass.
Grinding mills for wood pulp, G. King, Oswego, N. Y.
Hat brims, J. Peters et al., Philadelphia, Pa.
Heat, utilizing from furnaces, A. H. Heatington, Rochester, N. Y.
Organs and apparatus for playing, G. H. Chinnock et al., Brooklyn, N. Y.
Printing press, J. L. Firm et al., —, N. J.
Saw sharpening machinery, G. W. Dudley et al., Waynesborough, Va.
Screws threads, machinery for cutting, F. Armstrong, Bridgeport, Conn.
Telegraphic cables, manufacture of, M. M. Manly et al., Philadelphia, Pa.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 21. [NEW SERIES.] NEW YORK, MAY 22, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

Artificial Respiration.

The *Medical Press and Circular*, 1880, informs us that in a recent communication to the French Academy, Professor Fort raises again the question of premature interments. One fact he mentions is, that he was enabled to restore to life a child three years old, by practicing artificial respiration on it four hours, commencing three hours and a half after apparent death. Another case was communicated to him by Dr. Fournol, of Billancourt, who, in July, 1878, reanimated a nearly drowned person after four hours of artificial respiration. This person had been in the water ten minutes, and the doctor arrived one hour after asphyxia. Professor Fort insists also on the utility of artificial respiration in cases of poisoning, in order to eliminate the poisons from the lungs and glands. The length of time it is desirable to practice artificial respiration in any case of apparent death from asphyxia, Professor Fort has not yet determined, but his general conclusion is that it should be maintained perseveringly for several hours.

The Efficiency of the Water Trap.

A contemporary publishes an important experimental investigation by Dr. Neil Carmichael concerning the trap and water closet system, and their relation to sewage products, gaseous and others. As the result of this investigation, Dr. Carmichael came to the conclusion that an efficient water trap excludes soil pipe atmosphere to such an extent that what escapes through the water is so little in amount, and so purified by filtration, as to be perfectly harmless. The water trap, he further concludes, stops entirely the passage of all germs and particles from the air of the soil pipe, including the specific germs or contagia of disease, which, so far as is known, are particulate. He thus traverses entirely the belief so largely entertained that the water of a trap, however perfect in arrangement, will absorb the air of the soil pipe until saturated, and then give it off harmfully on the house side. He would rehabilitate the old faith in the sufficiency of the water to insure safety, and he would refer the harm from traps to their imperfect sealing, or to various deteriorations in the structure of the water closet or soil pipe which permit direct communication between the air of a house and the air of the soil pipe. The series of experiments on which Dr. Carmichael has founded these conclusions are exceedingly ingenious, and would certainly appear to justify them, but we doubt whether he has been sufficiently careful in indicating the conditions under which the safety of the water trap can be secured.—*Lancet.*

THE BABCOCK & WILCOX WATER TUBE BOILER.

Efficiency, economy in the use of fuel, and safety are qualities which are absolutely requisite in a boiler in these days of the wide application of steam, and notwithstanding the care taken in the construction and use of shell boilers for either high or low pressure, neither the user nor the people in the vicinity of them can feel any degree of safety.

The boiler shown in our illustrations is not only one of the most economical and efficient, but it is absolutely safe from destructive explosion at any pressure, and possesses, in addition, the quality of lightness and portability of parts, a very important feature when the matter of transportation is considered.

Our front page illustration represents a nest of four boilers of the Babcock & Wilcox type. These boilers were recently constructed, and are now in successful operation at the Standard Oil Company's Refinery, Greenpoint, L. I. The side elevation gives an excellent idea of the construction of the boiler and furnace, and the relative arrangement of the various parts.

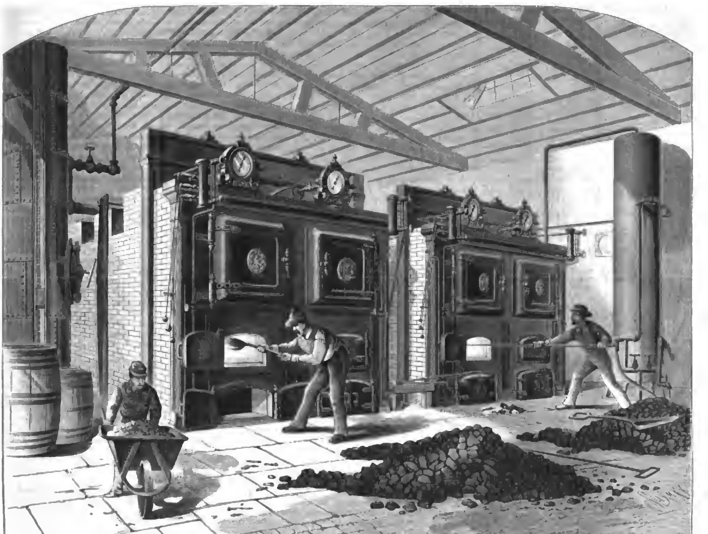
It will be seen that the construction of the boiler is radically different from the ordinary flue boiler, in which the water surrounds the tubes and flues, as in this boiler the order of things is reversed; the water circulates through the tubes and two drums, the exterior surface of which affords a very large and effective heating surface.

This boiler is composed of lap-welded wrought iron tubes, placed in an inclined position, and connected with each other, and with a horizontal steam and water drum, by vertical passages at each end, while a mud drum connects the tubes at the rear and lowest point in the boiler.

The end connections are in one piece for each vertical row of tubes, and are of such form that the tubes are "staggered" (or so placed that each horizontal row comes over the spaces in the previous row). The holes are accurately sized, and the tubes fixed therein by an expander. These are connected with the water drum, and the mud drum also, by short tubes expanded into bored holes, doing away with all bolts, and leaving a clear passage way between the several parts. The openings for cleaning opposite the end of each tube are closed by hand-hole plates, the joints of which are made in the most thorough manner by milling the surfaces to accurate metallic contact. They are tested and made tight, under a hydrostatic pressure of 500 pounds per square inch, iron to iron, and without packing, rubber, or other perishable substance.

The fire is made under the front or higher end of the tubes,

[*Continued on page* 325.]



BABCOCK & WILCOX BOILERS AT THE STANDARD OIL COMPANY'S REFINERY GREENPOINT, L. I.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, MAY 22, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 229.

For the Week ending May 22, 1880.

Price 10 cents. For sale by all newsdealers.

PATENT LAW AND EQUITY.

We lately referred to suggested amendments to the patent law at the Senate hearing in relation to bill No. 4412, which passed the House several weeks ago, and the text of which we gave in our issue of March 6. The amendments suggested by members of the committee themselves during the hearing, plainly indicate that this particular bill will never be approved by the Senate in its present form, yet we do not know but, outrageous as it was, its introduction, and even its passage through the House, has been productive of some good, for it has opened the eyes of those interested in patents to the necessity of constant watchfulness, if, in the present state of the public mind, they would protect their property, and the discussion it has provoked has assisted to spread among the community a better knowledge of the principles of patent law. But taking it for granted that here, as Mr. Playfair says is the case in England, there is now "a general *consensus* of public opinion, that it would be dangerous to national interests to abolish patents for inventions," as bill No. 4412 would practically have done in many cases, there can be no doubt but that *some* change in our present law, or in the equalized methods of practice thereunder, is now generally called for.

Perhaps the principal fault found with the law as it now stands arises from the fact that, in so many cases, people buying what is openly sold are afterward compelled to pay again to other parties for what they had already bought, or supposed they had bought of those who had a right to sell. This is where the opposition to the present law has heretofore derived its principal strength in the popular mind, and without this support, from those who honestly think they have been aggrieved, all the efforts of interested parties in opposition to the rights of patentees would be of little avail.

Next to this complaint, probably, would come that of taxation for patents on things long in common use, where the patentee could make out a case of infringement only by a great stretch of his claim, but would expect parties to pay a small tax rather than "go to law" about it. This class of cases are best met by the clubbing together of the defendants to share the expense of a defense, a course which has frequently been adopted in the Eastern and Middle States, and which affords, under the law, a ready means of obtaining justice at but moderate cost to each one of the defendants. Much less is now said against the patent law on this score than was formerly urged, so feasible and practical has this mode of defense proved.

Added to the above causes of complaint, and as a later issue, there has been developed an increasing tendency among a certain proportion of the legal fraternity to charge excessive costs for proceedings which are really only *pro forma*; that is, where the cases are so plain that the defendant would not, with any proper notification, allow them to go to trial, or be brought at all, the lawyers have, by a little sharp practice, been able to collect ten times the royalty charged by the patentee, *as costs*, where no expense at all had been incurred. We have heard of cases where those who had unwittingly infringed, upon calling to pay the regular royalty, were victimized by the attorneys, without the consent of the patentee, and charged many times the sum they should have paid, although the lawyers did not know they had infringed, and did not know against whom to make out the papers, except as they obtained the particulars from the one who had called to pay up, when the papers were made out while their victim was waiting. We suppose that, where the latter cannot prove these facts, the business is all done "according to law," though it is certainly very far from equity, and it is a kind of practice which injures the patentee as directly as it robs the public.

As to those who are called upon to pay for a patent a second time, after having once bought a supposed right, there probably can be no law framed which would completely obviate the evil. The issuing of the patent gives the patentee a *prima facie* claim against any one using the patented article, device, process, invention, or discovery, without the consent of the patentee or his representative. Whether this claim is good, should the presumed infringer decline to recognize it, the United States courts must decide. Many cases of this kind, usually brought as equity trials, take from two to five years, and costs thousands of dollars, when perhaps the royalty charged by the patentee, or the damages which might be obtained from one infringer, would be trifling; but injunctions will not be issued by the courts against manufacturers or users until the case has been decided, and irresponsible parties may, meanwhile, manufacture and sell indiscriminately, with no practical remedy in the hands of the patentee. The latter may, and generally does, give notice through the papers that users of such and such an article, device, or process, are infringing, but the manufacturer, or those interested in denying the validity of the patent, generally circulate counter statements.

Now, in all such cases, it is probably safe to say that at least nine-tenths of the infringers know that there is a patent on the article, and when they purchase without acknowledging the rights of the patentee, they virtually "take chances" on the question of the ability of the latter to make good his claim in the courts: if they lose, we do not see what right they have to complain, as against the patentee. Although they may have good cause for saying that the manufacturer, or the one of whom they had bought, misrepresented the matter to them, that is a thing for which neither the law nor the patentee can be blamed, always supposing that the latter has given due public notice of his claim, as one who is conducting a tedious and expensive litigation through the United States courts would unquestionably find it his interest to do. As the principal features of the law become generally better understood, we find that complaints on this score are steadily diminishing.

As to the last issue, touching excessive costs where there has been no expense, there was considerable discussion in the late Senate hearing, and here the point was particularly brought out that it was entirely unnecessary to injure the rights of the patentee in seeking a remedy—that, in fact, this was an extremely roundabout and impracticable way. It is only the mode of practice here which needs amendment, and Mr. Storrow, of Boston, with the evident approval of the committee, urged that a bill be framed which should provide that the defendant might come into court and confess judgment before suit, and then be excused from costs or have to pay only such as had been actually incurred to that time.

This is, of course, in cases where it is not sought to question the validity of a patent, and no claim is set up in the way of a genuine defense to make it to the interest of the lawyers of the patentee to have the costs as light as possible. Some such law as this would be likely to do away with much entirely unnecessary litigation, and we do not see why its provisions should not apply as well to all cases brought in the United States courts. It would be only carrying out the doctrine of the common law, and ought to be made so as to bring down the costs in patent cases, where no genuine defense was set up, so that they would not exceed the costs of suits for similar amounts in the local or State courts.

TWO METEORITES.

We are indebted to M. John Isaac, of the San Bernardino (Cal.) *Times*, for an excellent photograph of a large meteorite, found at Ivanpah, near that place, a few months ago. It is the second specimen hitherto found in California. It weighed 128 pounds, and is nearly pure iron. It is covered with curious cup-shaped cavities, which in more than one case may be called holes. On one end a natural face shows a network of well defined crystals. A slab has been cut from the large mass, and the polished surface acted on by dilute nitric acid, by which treatment Widmannstattian figures of remarkable beauty were developed. This is the only holosiderite found on the Pacific coast as far as known, which yields these curious markings.

A small mass of meteoric iron was found in California in 1871, and was described by Prof. Silliman in the *American Journal of Science and Arts* for July, 1873.

In a communication on the last found specimen, Mr. H. G. Hanks, of the State Geological Society, refers to the large masses of meteoric iron which have been found in Mexico, New Mexico, and Arizona, and to the tradition among the inhabitants of Tucson, Arizona, that a shower of meteorites fell in the Santa Caterina Mountains about 200 years ago. The Smithsonian Institution has the 1,400 pound Irwin-Ainsa meteorite found near Tucson. Another specimen from Tucson, presented to the city of San Francisco, by General James H. Carleton, is now at the rooms of the California Pioneers. A description of it may be found in the proceedings of the California Academy of Science, vol. 3, folio 48, and a full analysis by Prof. Bush, of Yale College. In the same volume, folio 80, Prof. Whitney has shown that a belt or path of meteorites lies nearly in a line from the Colorado river at La Paz to San Luis Potosi, in Mexico, possibly fragments of the same meteor. A mass of metallic iron was found by Dr. Evans on Bald Mountain, near Port Orford, in Oregon. San Bernardino is in the same general direction, and Mr. Hanks suggests that it might be well to look for other fragments along the same line.

Photographs of the Westville (Ind.) meteorite have been kindly furnished us by Mr. W. C. Ransbury, of that place, with an account of the circumstances attending its fall, about the first of November, 1876. It was not found until the following spring. While preparing a corn field for plowing, Mr. G. D. Wright, of Westville, La Porte county, came to a place where the ground had been furrowed for several feet since the previous year's cultivation, and in the western end of the furrow the meteorite lay. It is described as a dark, irregular mass full of cavities and irregular projections. It weighs 224 pounds, and measures 25 by 24 by 16½ inches. It has not been analyzed. It appears to contain iron (in great abundance), copper, and nickel, also silica and mica. The stone is still in the possession of Mr. Wright.

HOUSEHOLD FUNGI.

At a recent meeting of the Buffalo Microscopical Club, Mr. Jas. W. Ward exhibited a piece of glass which had been over a picture on one of the walls of his residence. It was covered with a very peculiar and interesting species of fungus, which withstood the action of soap and water in attempting to remove it. He attributed the growth to the exhalations of the breath of persons who had been in the room, and since noticing this fungus on the glass, he had examined several of a similar nature in other rooms and found them alike.

In the discussion that followed, Dr. Lucien Howe thought the fungus similar to that which attacks the common house fly, producing the well known contagious disease of flies. Dr. W. C. Barrett likened it to the fungi which permeates the walls of hospitals and other public buildings; and since then, according to the *Journal of Microscopy*, the president of the club, Prof. D. S. Kellicott, has found the same fungi on the windows of the Central School Building, and the

City and County Hall of Buffalo. Whether these fungi are associated with any human disease does not appear. If they will kill flies without harming humanity their multiplication is rather to be desired.

A NEW INDUSTRIAL SCHOOL OF ART IN NEW YORK.

The hopes expressed, at the recent dedication of the new building of the Metropolitan Museum, with regard to the future of the industrial art school in connection therewith, bid fair to be realized much sooner than was then anticipated. A liberal gentleman, whose name is withheld at his own request, has offered the trustees of the Museum the use of a piece of ground fronting 200 feet in First avenue, near Sixty-seventh street, and extending in the rear 130 feet, for three years free of rent. In addition, he proposed to erect upon it, at his own expense, a suitable building for such schools, with a frontage of 200 feet on the avenue and two wings running back to the end of the lot. Moreover, he agreed to support these schools for three years at his own expense—allowing them to be entirely under the supervision of the trustees of the Museum during this period. All this he proposed to do in order to demonstrate beyond peradventure the advantages and necessity of such schools. The trustees of the Museum naturally lost no time in accepting the generous proposition.

It is expected that the new building will be ready for the opening of the schools in the autumn of the present year. It will be of brick and stone, and will cost about $10,000. In these schools will be regular day classes, and if occasion seems to demand it, night classes. It is intended that there shall be classes in drawing and designing, not only as applied to woodwork and iron, but a painting department will be opened, in which will be taught the principles of mixing colors, their chemical composition, and the effects of light and temperature upon them, the laws of harmonies and contrasts. Another department will be devoted to technical instruction in woodwork, and probably others in the working of iron and stone.

Diplomas and prizes will be given to the most successful competitors, and every effort will be made to advance and strengthen American industrial art.

Earthquake Shocks Superficial.

The superficial character of a Nevada earthquake was noticed some months ago. The Eureka (Nevada) *Leader* of April 17, relates another and similar experience. A miner at work in a mine on Prospect Mountain during the last shake at Secret Cañon says that while the tremor was plainly felt by his partners on the surface, he, at a depth of eighty feet, noticed nothing unusual.

The same miner says that through an experience of fifteen years underground he has observed one peculiar phenomenon, namely, that loose stones and bits of earth in mines are sure to fall between twelve and two o'clock at night. About this time it seems that everything begins to stir, and immediately after twelve, although the mine has been as still as the tomb before, the fall of little particles of rock and earth will be heard, and if there is a caving piece of ground in the mine it is sure to give way.

It would be interesting to know if other miners have ever observed this phenomenon.

A Recent Nickel Plating Decision.

Judge Blatchford, of the United States Circuit Court, has just rendered an important decision in the case of the United Nickel Company against Pendleton, which was a test suit with regard to the nickel plating patent. The case was argued some two months ago on a motion to attach for contempt, and the decision was awaited with much interest by the entire nickel plating trade. Judge Blatchford finds, as a matter of fact, that Pendleton was not using the double acetate solution, and denied the motion for contempt. There is much rejoicing among the nickel platers, who were bound to pay a royalty averaging about two cents a gallon per day, according to the capacity of the tank used for the solution, and this regardless of the quantity consumed, or of the fact that it might be empty. As these tanks in some large establishments equal 2,000 gallons, the tax was regarded as peculiarly onerous. Even for a 100 gallon tank $2 a day or $12 a week was a payment sometimes complained of as a grievous hardship. Unfortunately for this class, the great body of manufacturers are committed for another year, having taken out their licenses dating from the 1st of April, the delay in rendering the decision thus working in favor of the plaintiffs to this extent.—*World.*

A Fat Boiler Explodes.

A fat boiler in a soap factory in Detroit exploded May 2, fortunately without killing any one. The boiler was a cylindrical shell of quarter inch iron, twelve feet high, five feet in diameter, and surmounted by a conical top, in which was a man-hole capped as is usual in steam boilers. The boiler contained between 6,000 and 7,000 pounds of tallow, boiling under a steam pressure of 35 pounds. The top of the boiler was thrown up through the second floor and roof of the building, over a corner of a three story building, and fell about a hundred feet from where it started. A shower of grease covered an area from 100 to 300 feet wide and about 400 feet long. The boiler had been used six years, and had been corroded within by the fatty acids until it was no thicker than a silver five cent piece. A considerable portion of the factory was wrecked, but only one man was hurt, and he but slightly.

THE NATIONAL ACADEMY OF SCIENCE.

GLEANINGS FROM PAPERS READ.

Mention was made last week of the more important proceedings of the meeting of the National Academy of Science, April 20-23. In his paper on the sea urchins of the Challenger Expedition, Prof. Agassiz said that the new species taken belonged to a fauna not known along our shores, but limited to the slope of the continental plateau, at depths ranging from 100 to 2,900 fathoms, and called by him the Continental and Oceanic Districts. From these districts the Challenger had collected forty-nine new species, and the Coast Survey and other expeditions about thirty-five. These were all in addition to the two hundred species known in 1874. Only two new shore species were found by the Challenger. The most interesting of recent discoveries in the sea urchin line are of two new families of this group, which represent more or less ancient fossil types of Palæozoic and Cretaceous times, types previously supposed not to exist in recent seas.

The marine districts into which the sea bottom is divided in indicating the bathymetrical limits of sea urchins were given as follows: The littoral, down to 100 or 150 fathoms; the continental, from 50 to 600 fathoms; and the oceanic, from 500 to 2,900. The continental sea urchins date back to the Tertiary, and the oceanic to the time of the chalk, of which they are very characteristic. All of the species collected by the Challenger had previously been collected by the Coast Survey in 1867 and later years.

Professor Packard's study of the internal structure of the brain of king crabs (*Limulus*), commonly known as horse-foot crabs, led him to divide the histological elements into three kinds: 1. Large ganglion cells, filled densely with granules, and with a well defined nucleus similarly filled, and with a granular nucleolus. These cells terminate in large fibers, which subdivide. 2. Nerve fibers; these, like the large-sized ganglion cells from which they originate, are stained tawny brown with osmic acid. These fibers are coarse, their granular contents homogeneous. 3. Numerous very small nerve fibers, arising from very small nucleated cells. 4. Rounded masses inclosed in a network of fibers. In staining they resemble the *marksubstanz* of Diehl and the *punctsubstanz* of Leydig, but here the resemblance ends, as these balls are apparently composed of very minute nucleated cells and fine fibers arising from them. The general topography of the brain of *Limulus* is on a simple plan compared with that of *Decapodous crustacea* and insects. The brain is mostly composed of large irregular rounded masses or balls of granules, with a thick fungoid or ruffle-like periphery, formed by a layer of secondary smaller, rounded, granular masses. The lower half of, or two-thirds of, the entire brain is filled with these fungoid masses. In the upper third of the brain, whence the nerves originate, the larger ganglionic cells and the nerve fibers appear and preserve a definite topographical relation to the entire brain. The asymmetry of the brain is remarkable. Histologically, judging by his specimens of the brain of the lobster, the brain of *Limulus* agrees with that of other arthropods in having similar large ganglion cells. The smaller ganglion cells, so abundant in the brains of insects and crustacea, are wanting in *Limulus*. There are in *Limulus* no *ballen substans* masses homologous with those of the other arthropoda. Topographically the internal structure of the brain of *Limulus* is constructed on a wholly different type from that of any other arthropodous type known; so much so that it seems useless to attempt to homologize the different regions in the two types of brain. The plan is simple in *Limulus*; much more complicated in arthropods, especially in the brain of the crayfish, as from the decapodous brain there arises two pairs of anternal nerves besides the optic pair, and in external form the two types of brain are entirely unlike.

In his communication on the brains of extinct animals, Prof. Marsh reaffirmed his discoveries touching the law of brain growth, viz.: 1. All tertiary mammals had small brains. 2. There was a gradual increase in the size of the brain during this period. 3. This increase was mainly confined to the cerebral hemispheres, or higher portion of the brain. 4. In some groups the convolutions of the brain have gradually become more complicated. 5. In some the cerebellum and olfactory lobes have even diminished in size. 6. There is some evidence that the same general law of brain growth holds good for birds and reptiles from the cretaceous to the present time.

A series of observations on the *Odontornithes*, or birds with teeth, from the cretaceous was first presented, and the skull and brain of the extinct *Hesperornis* were compared with those of the Loon (*Colymbus*), and the former was found to have a brain of less than one-third the size of the latter, and much more reptilian in form and proportion. The brain in two *Dinosaurians* (*Morosaurus* and *Stegosaurus*) was next compared with that of the crocodile. *Stegosaurus* was found to have a brain very much smaller than the crocodile, and other Dinosaurs agreed essentially in the same feature. It was also shown that of ancient animals those with small brains and large bodies were especially those that became extinct, those with large brains being more likely to survive.

In his paper on the Taconic system in geology, discovered by Eaton and maintained by Emmons, Prof. T. Sterry Hunt reviewed the evidence of a great and widespread series of rocks, pre-Cambrian in age, and occupying the position assigned by Emmons to the Lower Taconic or Taconian system, which, according to him, extends continuously along the Appalachian Valley from Vermont to Alabama, and more or less occupies large areas to the southwest of the Blue Ridge, from Virginia to Georgia, constituting in South Carolina the Itacolumite series of Lieber. Within the vast area occupied by these rocks in the great valley have been found a few small areas of fossiliferous strata, belonging chiefly to the Ordorian or Lower Cambrian series, but the characters of the great mass of these rocks are such as to lead to the conclusion that they constitute, as maintained by Emmons, a more ancient series. To the Lower Taconian rocks belong the peculiar magnetic iron ores found at Reading, Cornwall, and Dillsburg, Penn., which have been by some geologists regarded as Mesozoic, but were by Rogers assigned to the base of the Palæozoic. To this same series belong the limestones of the great valley, which occur in clays derived from the subaerial decay of the rocks. These, in their unchanged condition, contain beds and masses both of siderite and pyrites, and the alteration of these *in situ* has given rise to the limonites. In the formation of this from the siderite, or iron carbonate, it was pointed out by the speaker that there is a contraction of volume equal to about 20 per cent, to which is due the cellular character of the limonites and the frequent occurrence in them of Geodes. These older rocks are not without traces of organic life, having yielded in the Appalachian Valley the original *Scolithes* and related markings, besides obscure *Brachiopods*; and in Ontario, besides similar Scolithes-like markings, a form apparently identical with the more ancient gneisses. We may hope to find in the Taconian series a fauna which shall help to fill the wide interval that now divides the Eozoic rocks from the Lower Cambrian.

Describing the experiments lately made at the Allegheny Observatory in the measurement of radiant heat, Prof. Langley told of an improved thermo-electric apparatus due a product of the American iron industry. The experiments on a great variety of substances had thus far shown that iron in extreme thinness (cut into strips about one-third of a millimeter wide and 1-500 of a millimeter thick) was the best. The speaker exhibited specimens of iron rolled in the Pittsburg mills, which were so surprisingly thin that from 10,000 to 12,000 sheets laid on each other equaled only one inch in thickness. From these was produced an instrument which had almost the promptness of action toward radiant heat which the eye has toward light, and which possessed a greater sensitiveness than any thermopile, and the speaker hoped it might prove useful to other workers in the same line of research as himself.

In discussing the absolute brightness of the solar corona, Prof. Harkness, of the United States Naval Observatory, said that as the sun's limb is approached the intensity of the coronal light increases with such enormous rapidity that its total illuminating power is mainly derived from regions within two or three minutes of the solar disk. Hence, if the intrinsic brightness of the corona is even approximately constant, the darkness during totality should be much greater in long eclipses than in short ones; and in a brief totality the streamers may possibly be obliterated by the intensity of the inner corona. Methods were explained and formulæ given by means of which the observations of Prof. Pickering on the total eclipse of 1870, and the observations of Prof. Langley on the eclipse of July, 1878, were utilized and rendered comparable, and the conclusions finally reached respecting the amount and distribution of light in the corona of July 29, 1878, were summarized as follows:

1. The total light of the corona was 0·072 that of a standard candle at one foot distance; or 3·8 times that of the full moon; or 0·0000069 that of the sun.

2. The photographs show that the coronal light varied inversely as the square of the distance from the sun's limb.

Church Towers.

The towers of Cologne Cathedral are now the highest in the world, the height they have attained being 5 feet higher than the tower of St. Nicholas's Church in Hamburg, which has hitherto been the highest edifice. Ultimately they will be 51 feet 10 inches higher. The *Cologne Gazette* gives the following as the heights of the chief high buildings in the world: Towers of Cologne Cathedral, 524 feet 11 inches from the pavement of the cloisters, or 515 feet 1 inch from the floor of the church; tower of St. Nicholas, at Hamburg, 473 feet 1 inch; cupola of St. Peter's, Rome, 469 feet 2 inches; cathedral spire at Strasburg, 465 feet 11 inches; Pyramid of Cheops, 449 feet 5 inches; tower of St. Stephen's, Vienna, 443 feet 10 inches; tower of St. Martin's, Landshut, 434 feet 8 inches; cathedral spire at Freiburg, 410 feet 1 inch; cathedral of Antwerp, 404 feet 10 inches; cathedral of Florence, 390 feet 5 inches; St. Paul's, London, 365 feet 1 inch; ridge tiles of Cologne Cathedral, 360 feet 3 inches; cathedral tower at Magdeburg, 339 feet 11 inches; tower of the new Votive Church at Vienna, 314 feet 11 inches; tower of the Rath haus at Berlin, 288 feet 8 inches; towers of Notre Dame, at Paris, 232 feet 11 inches.

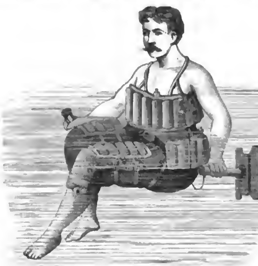
An Invention Wanted.

A correspondent, writing from Colorado, says there is much need in those parts of a portable steam drill for prospecting purposes. It should be so constructed that it could be packed on a mule or carried in parts by two men. Its weight should not exceed 150 pounds, and it should not cost over $200. The machine should be capable of drilling granite to a depth of 50 feet, making a bore three-eighths to three-fourths inch in diameter. Our correspondent is confident that a large market would be found for such a drill in Colorado for gold and silver prospecting.

NOVEL SWIMMING DEVICE.

Our engraving represents a simple apparatus for the use of bathers and persons unable to swim, the invention of Mr. A. Gamonet, of Lyons, France.

Inflated India rubber bags support the swimmer, and enable him to sit upright with head and shoulders above water, so that he can propel himself. The principal novelty of this contrivance lies in the propelling device, which is constructed so as to collapse when pulled forward, and to spread open when pushed back, like a duck's foot when swimming. The propellers are suspended by chains or cords attached to the buoying jacket.



NOVEL SWIMMING DEVICE.

NEW INVENTIONS.

Mr. William C. Beattie, of Taunton, Mass., has patented improvements in jewel cases and analogous articles; it consists in a stand or case, having a stationary bottom portion, a stationary and elevated top or cover, and two standards connecting the said top and bottom portion and forming a handle, in combination with one or more receptacles hinged upon the standards and folding horizontally between the stationary top and bottom portions.

A new key ring, which can be easily opened and may be locked securely, has been patented by Mr. Bryant H. Melendy, of Battle Creek, Mich. The invention consists of a flat ring a part of which is straight and provided with a cut, thus forming two ends and permitting the ring to be bent sidewise for admitting the keys. One of the ends of the ring is provided with a small shoulder, and a clasp is pivoted to the other end, which clasp swings over the end with the shoulder and locks it.

Mr. William E. Ferguson, of New York city, has patented an improved device for preventing the shifting of grain cargoes in vessels, and to strengthen the vessel at its weakest point, or at the point exposed to the greatest strain when the vessel is loaded to the dead-weight capacity with a cargo of grain.

Mr. William C. Beattie, of Taunton, Mass., has patented an improvement in pickle casters, butter dishes, jewel cases, sugar dishes, and other analogous covered dishes, which is designed to raise the cover of the article and maintain it in an elevated position.

An improvement in automatic car couplings has been patented by Mr. Orlo H. Drinkwater, of Cedar Point, Kan. It consists in a peculiar construction and arrangement of parts which cannot be clearly described without engravings.

A water and wind mill, which the inventor designates as a "wing-motor," of especial simplicity of construction, automatic in the adjustment of its sails, and capable of utilizing a large percentage of the power of the wind and current of water, has been patented by Mr. Jean L. Nevers, of Pass Christian, Miss.

Mr. Robert F. Dobson, of Darlington, Wis., has patented improvements in that class of weighing scales in which the weight of the object to be weighed is made to deflect a lever over a curved scale bar, and throw a weight carried by the lever into a position approaching more nearly the horizontal, in which the leverage of said weight is greater.

Messrs. Charles H. Spray and Edward M. Bush, of Seymour, Ind., have patented an improvement in the class of ovens of cooking stoves and ranges whose doors have a movable shelf so connected therewith that the opening and closing of the doors will slide the shelf along the bottom of the oven. The improvement relates to a shelf or false bottom, which is made the full size of the true bottom of the oven chamber, and is supported in guides and moved out and in, as the door opens and closes, by means of a rack and a segmental toothed lever that is connected with and operated by the door.

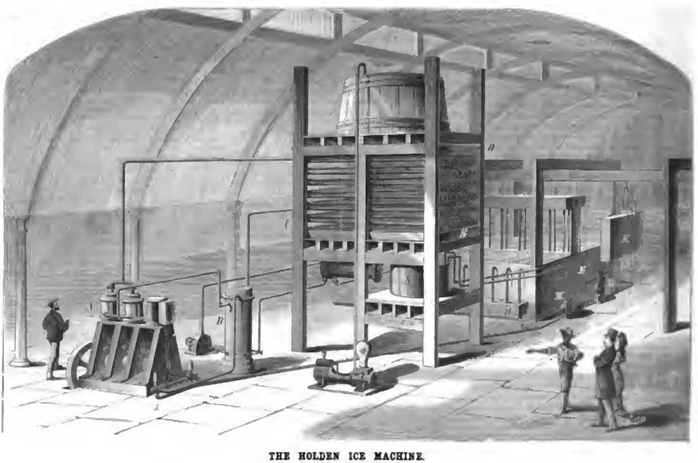
A LARGE ICE MACHINE.

The successful refrigerating apparatus of Messrs. D. L. Holden & Bros., 725 Sansom street, Philadelphia, as first developed for use in breweries, was quite fully described and illustrated in the SCIENTIFIC AMERICAN for August 18, 1877. Subsequent improvements and additions, fitting the apparatus for the manufacture of ice, were shown in our issue of March 16, 1878; and to-day we illustrate a section of what will probably be the largest ice factory in the world, the same system being employed. The factory is now approaching completion for the Compania Habanero de Hielo, of which Guillermo de Zaldo is president, at Havana, Cuba.

As in all machines of this class, refrigeration is produced by the conversion of a volatile liquid into vapor by the action of the exhaust pump; the vapor being recondensed by passing through coils immersed in running water, aided if necessary by the power of compression exerted by force pumps; thus pursuing an endless round of vaporization and recondensation. When this liquid is volatilized in the refrigerator, intense cold is produced and utilized by chilling a non-congealing liquid, which in turn serves to reduce the temperature of the air to be cooled, or, in the case of ice machines, the water to be frozen.

With this brief explanation of the general process the special working of the great machine figured in the accompanying illustration will be easily understood.

In the left foreground will be seen the vapor pumps, A, and the steam engine, resting on the same bed plate. Next in rear stands the upright refrigerator, B, with a pressure blower to the left. The volatile fluid used is chymogene. Behind the refrigerator, supported by a timber staging and surmounted by a large tank, are the condensers, C; the large upper coil condenser being of wrought iron, and the lower a cylindrical shell containing U tubes, through which the vapor to be liquefied passes. In the middle foreground stands the pump, which controls the fresh water supply, raising it to the tank above, whence it passes around the condensers, thence to the spray pan, D, whence it trickles to the lower pan, E, from which it is led away as waste or to the steam boiler as feed water. Back of the condensers is the ice box, divided into two compartments, containing twenty-eight congealers, through which the cold brine from the distributing system of pipes above the ice box is circulated. The overflow from the congealers falls into the double trough, H, whence the brine is led to the circulating pumps, I, which return it to the refrigerator. The fresh water to be frozen surrounds the congealers, and when converted into ice the congealers are loosened by a circulation of warmer brine. The ice is then hoisted out and conveyed to the point of delivery, K, by means of trucks running upon the rail track above. The pump, L, for the circulation of the fresh water in the ice box, to prevent the imprisonment of air-bubbles in the ice. The rotary pump, M, is used to circulate the brine to be warmed through a coil of pipe immersed in the tank of fresh water, N, which water is to be run into the ice box to be frozen. By this arrangement there is no loss of cooling effect when the brine is warmed for thawing out the convertors. This machine is guaranteed to make ten tons of ice a day in Havana. Under more favorable conditions of temperature its capacity is rated at twenty tons of ice in twenty-four hours

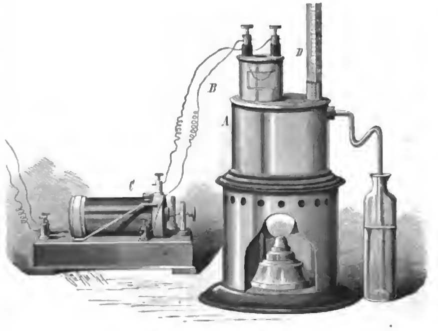


THE HOLDEN ICE MACHINE.

NEW OIL-TESTING APPARATUS.

The annexed engraving represents a new oil-testing device, recently patented by Mr. F. S. Pease, of Buffalo, N. Y., and designed for testing petroleum oils by electricity. A water bath, A, supported by a heating chamber, contains a cup for receiving oil, above which there is a dome, B, provided with two insulated binding posts, from which two or more electrodes project downward. These electrodes are provided with switches, by which one, two, or three sparks can be given at different points, and twenty or more changes can be made. The binding posts at the top of the dome are connected with the terminals of the secondary wire of an induction coil, C. A thermometer, D, is inserted in the top of the device to indicate the temperature of the oil, and an overflow pipe leads from the side of the oil cup near the top, and has a slight bend or trap formed in it to prevent the escape of vapors driven from the oil, while it admits of the overflow of the oil in case of its expansion, and always keeps the oil at a uniform height. The induction coil furnishes a constant means of igniting the vapor driven off from the oil, without the admission of air.

The ordinary closed and open test now in general use cannot be called absolutely correct, owing to the variations in expansion, the uncertainty in the application of the fire to the oil, there being no standard established as to the amount of fire to be applied or the point at which the vapor is to be ignited, the application of the point of light to the oil being optional with the operator. The new electrical test obviates all these difficulties, and secures tests which are always the same, and absolutely correct to a fraction of a degree. It determines the expansion of the oil, accounts for, corrects, and measures it; also prevents the escape of the hydrocarbon vapor, and regulates and keeps the oil at a fixed height and exact distance to the point of combustion, things never before accomplished. The electrodes are so arranged as to detect the vapor in its minimum quantity, and at any point relative to the surface of oil, and the igniting points being always at a determined distance from the oil. In testing refined oil the ordinary quantity used for the oil bath is about 3¼ fluid ounces, equal to 91·14 grammes; and properly refined, that is, an unmixed oil, when the distillation cut off at 52° Baumé, with a yield of, say 17 to 20 per cent, with a flash of 150° to 152° and fire test of 160° Fah., and market gravity of 45° to 46° Baumé, and real specific gravity of 800; such an oil, heated to its igniting point, expands four grammes, consequently the surface of the oil and vapor in the ordinary open or closed test approaches the fire at every degree of increase in the heat, and at its igniting point is 0·32 to 0·48 centimeter nearer than at the commencement of the test. No provision has ever before been made to compensate for this source of error.



PEASE'S OIL-TESTING APPARATUS.

In high test oils the amount of the hydrocarbon vapor is small, and is developed in detached quantities up to the point of combustion, and not of sufficient quantity to cover the oil test surface, and its tendency or attraction is to the moist sides of the oil bath; and when the test is usually made the vapor ignites at the side of the cup first, travels the entire circumference of the oil bath before flashing over the surface, while the center surface of the oil is comparatively free.

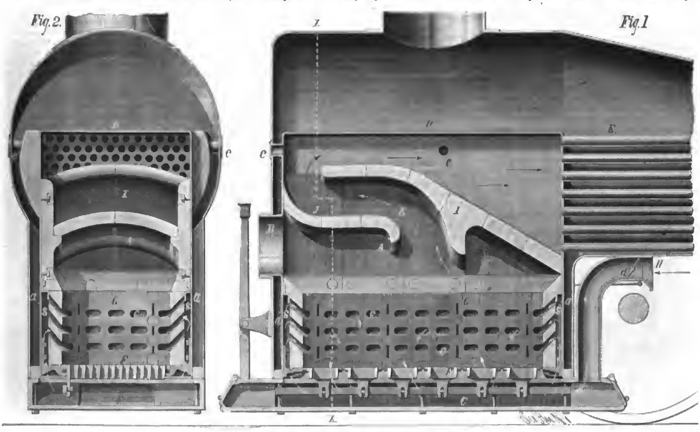
In low test oils the vapor is disengaged at every degree of increase in heat, making them more or less dangerous, and it only requires the half of one per cent of this vapor to make oils dangerous. Professor Chandler, of Columbia College, New York city, reports "that not one of seventy-eight samples selected at random throughout cities may be called safe."

Mr. Pease finds that refined petroleum oil is a good, if not a perfect, non-conductor of electricity; that by adjusting the two poles to a 0·32 of a centimeter apart, and placing them in the oil, a discharge from a powerful induction coil will not go through the oil, but will discharge between the two poles out of the oil, which are 1·92 of a centimeter apart. This fact enabled Mr. Pease to adjust and arrange a test to a minimum by arranging a pole in contact with the oil, with its point projecting upward toward a downwardly projecting point of the other pole, a moist surface of sufficient size being provided for the vapor. By this arrangement the vapor is detected, and explodes at the surface center of the oil bath as well as at other points, the spark being perpendicular to or from the oil. A horizontal discharge of sparks from the electrodes is a severe test, making a difference of one or more degrees for or against the oil. Mr. Pease's ingenuity has been displayed in a great many ways for the past 30 years, but it may be questioned whether his mechanical skill has ever better expressed itself than in the device referred to.

IMPROVED HOT-BLAST BOILER FURNACE.

In the minds of those conversant with the subject, no doubt exists as to the enormous waste going on in the majority of boiler furnaces in use to-day, and it is demonstrable that in many instances the better and even the greater part of the fuel goes out of the smoke stack unconsumed, and therefore unutilized. This is especially the case in the class of boilers used on locomotives and steamships, everything being sacrificed to compactness. Certain fundamental principles are involved in the combustion of fuel which seem to have been overlooked by inventors generally, and if not overlooked, the remedy for the evil results attending the non-observance of these principles seems to have been wanting. It is well known that boiler furnaces, as ordinarily arranged, are little else than gas retorts generating carbonic acid gas, carbonic oxide, and carbureted hydrogen: these gases under the conditions usually met in boiler furnaces are entirely wasted.

Carbonic acid is as incombustible as water, but if another portion of carbon be added or a portion of oxygen be withdrawn, carbonic oxide is formed, which, under the proper conditions, may be utilized and rendered a source of profit



PIKE'S HOT-BLAST BOILER FURNACE.

instead of loss, and, in some cases, even damage. These conditions are rarely or never met in ordinary boiler furnaces; they consist, first, in the introduction into the boiler furnace of a suitable amount of oxygen heated to insure its immediate admixture with the gases; and, second, in heating the mixed gases to the point of ignition before leaving the boiler furnace. These, all important requirements it is believed, are met in the boiler furnace shown in the accompanying illustrations. The distinctive features of this invention are the means by which air is heated and admitted to the fire box, and the means by which the combined gases are heated to the point of ignition before passing to the boiler.

Fig. 1 is a vertical longitudinal section of a locomotive fire box, showing the interior arrangement of fire walls and deflectors, and Fig. 2 is a vertical transverse section taken on line X X, in Fig. 1. In this boiler furnace, A is lined on all sides up to a certain height with firebrick, and is fed through the door, B, in the usual way. The ash pan, C, is provided with a blast pipe, H, having a flaring mouth opening toward the head of the locomotive, and capable of affording a more or less intense blast according as the locomotive is going fast or slow. The blast is also controlled by a valve, *d*, which may be operated by the fireman from the engine cab. The fire bricks, G, from the level of the grate, F, nearly up to the fire door and tubes, have a number of diagonal apertures, *e*, inclining downward toward the grate. These openings communicate with an air space, *s*, left between the bricks and the fire box, and opening into the ash pan below. By this arrangement the air entering the ash pan finds its way through the grates to support the combustion of the gases, and it also passes up the air space, *s*, and becomes highly heated by contact with the hot brick lining before it enters the fire box and the oxygen becomes mixed with the gases generated in the fire.

Between the fire bed and the crown sheet there are two peculiarly shaped arches, I, J, having between them the curved flue or throat, K, extending toward the rear end of the boiler. The main arch, I, extends from a point just below the tubes, upward and rearward, and is arched transversely and longitudinally, so that it cannot be displaced by any jarring or concussion that a locomotive is subject to in everyday use. The arch, J, is supported in a similar way, and both rest upon walls of refractory brick, the whole forming a complete self-sustaining arch.

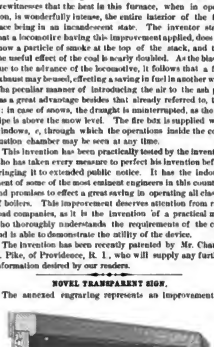
In actual use the heated oxygen, and the gases generated from the burning fuel, are thoroughly mixed, and in their passage through the flue, K, between the highly heated arches, I J, becomes ignited, and is consumed before it can be sufficiently cooled to extinguish the flame. We are informed by eyewitnesses that the heat in this furnace, when in operation, is wonderfully intense, the entire interior of the furnace being in an incandescent state. The inventor states that a locomotive having this improvement applied, does not show a particle of smoke at the top of the stack, and that the useful effect of the coal is nearly doubled. As the blast is due to the advance of the locomotive, it follows that a free exhaust may be used, effecting a saving in fuel in another way. The peculiar manner of introducing the air to the ash pan has a great advantage besides that already referred to, that is: in case of snows, the draught is uninterrupted, as the air pipe is above the snow level. The fire box is supplied with windows, *c*, through which the operations inside the combustion chamber may be seen at any time.

This invention has been practically tested by the inventor, who has taken every measure to perfect his invention before bringing it to extended public notice. It has the indorsement of some of the most eminent engineers in this country, and promises to effect a great saving in operating all classes of boilers. This improvement deserves attention from railroad companies, as it is the invention of a practical man who thoroughly understands the requirements of the case and is able to demonstrate the utility of the device.

The invention has been recently patented by Mr. Charles F. Pike, of Providence, R. I., who will supply any further information desired by our readers.

NOVEL TRANSPARENT SIGN.

The annexed engraving represents an improvement in



CHILD'S TRANSPARENT SIGN.

transparent signs recently patented by Mr. Hubert Child, of Wichita, Kan. The invention is designed to furnish an attractive and durable sign; and it consists in "cutting in" a transparent letter on glass by means of an opaque color, and placing behind the glass another glass, and filling the inter space with broken glass, which may be either colorless or of different colors, so that when light shines through the transparent letter the plain character of the letter is broken up and diversified, producing very brilliant and striking effects.

Frost and steam have no injurious effect on the sign. It will retain its character for an unlimited time, and will always look bright and fresh.

The inventor proposes to select different colors of glass and produce a brilliant panel, to be moved by suitable mechanism behind a sign having transparent letters, and thus give to the letters a kaleidoscopic effect.

Further information in regard to this invention may be obtained by addressing the inventor as above.

A NOVEL THERMOSCOPE.

When chloride of cobalt is dissolved in a definite quantity of strong wine spirit, or alcohol slightly diluted with water, a solution is obtained the color of which varies in a curious manner with the temperature of the surrounding air. Exposed to cold air it develops a bright pink color, which, as

COBALT THERMOSCOPE.

the temperature of the air increases, passes through various shades of color, until at last, when the liquid becomes quite warm, it assumes a strong blue or violet blue hue. These color changes are primarily due to the fact that in the cold alcoholic solution the salt appropriates a portion of the water, and when heated it parts with this water of crystallization or hydration. When the proportions of the chloride of cobalt, alcohol, and water are properly adjusted, and the liquid is sealed in a narrow glass tube, it becomes quite sensitive to change of temperature, and the varied changes of tint when compared with a standardized color scale may serve, within certain limits, as a rough index of the temperature of surrounding bodies, thus constituting the little instrument, a thermoscope, if not entitling it to the name chromothermometer, which has been given it. The statements to the effect that changes of color are due to the action of light and electricity or atmospheric humidity, etc., are of course erroneous.

To prepare the solution dissolve a few crystals of chloride of cobalt (pure) in two or three drachms of warm water, and to this add strong alcohol until, when exposed to a temperature of about 70° Fah., the liquid presents a slaty color—intermediate between the pink and blue. The proportions will then stand at about twenty grains of the salt to the fluid ounce of alcohol. If too blue, more alcohol or a drop of water may be added to the solution; if it inclines too strongly to the pink a few more grains of the salt.

The solution may be poured into a long narrow test tube, leaving the upper part of the tube unoccupied, so that it may be subsequently drawn out, and sealed hermetically by means of the blowpipe.

The remarkable properties possessed by some of the solutions of this salt certainly suggest the possibility of applying it to something of greater practical utility than the curious toys in which it has thus far been chiefly employed.

IN the interest of every advance in mechanics and the arts we are pleased to note the favor in which the product of the recently invented board-cutting machine and steam seasoning presses of Messrs. Geo. W. Read & Co. are received. It is the universal sentiment of all who have once used their thin cut lumber that for strength, beauty of finish, and easy working, without shrinkage or warp, it is fully equal and in many respects superior to the sawed and planed. We observe in a late number of the *Cabinetmaker* the following editorial, showing that manufacturers on the other side of the Atlantic are availing themselves of its advantages:

"Messrs. Geo. A. Read & Co., of New York, have disposed of their French patents on drying presses and Bartlett's board cutting machine to a party in Paris, and this party has commenced the construction of one machine and three drying presses, and will shortly put up four more machines and twelve presses, to complete facilities for manufacturing on a large scale. According to the French law these machines are necessarily built in France."

The Edison Electrical Lamp.

To the Editor of the Scientific American:

I confess to no small degree of surprise at the article in your last edition, by Messrs. Morton, Mayer, and Thomas, on some electrical measurements of Edison's last lamp. I read the article with a great deal of pleasure, until I came to that portion comparing the light by gas from five pounds of coal with that by electricity from the same weight of coal, as developed in Edison's lamp, and my pleasure would not have been diminished, nor my surprise excited, if these gentlemen had compared the effect of that amount of gas used in *twelve* burners (instead of five) with twelve electric lamps. Messrs. Morton, Mayer, and Thomas certainly know that gas suffers nearly if not quite as much by subdivision as electricity, and why they should use a less number of gas burners than electric, is not at all clear. Let them give us the comparison between the two on an equal basis, and I apprehend there will be quite a difference in the figures.

It must be tolerably clear by this time that Edison's idea is the subdivision of the light, to make it practicable for domestic use, and I think he is entitled to great credit for having produced a lamp that will give us twelve such lights at an expenditure of only one and two thirds horse power, assuming Professor Morton's figures to be correct. And it would seem that we might expect men of national reputation, such as these gentlemen possess, to be just in criticising the results obtained by the advance guards of science.

W. A. CRAWFORD.

San Antonio, Texas, April 13, 1880.

Bleaching Teeth.

Dr. W. H. Atkinson, D.S., of this city, gives the following directions for treating discolored teeth: To bleach a tooth discolored by loss of its pulp: Carefully clean it out to the end of the root, going *through* the apex into the *always present latent abscess* at the end. After drying out as well as you can, proceed to fill nicely all the length of the canal in the root and the pulp chamber with oxychloride of zinc.

As soon as it is well hardened excavate out all the discolored dentine that can be spared without weakening the tooth. Then fill the nerve chamber with powdered alum, and wet it with Labaraque's solution of chloride of sodium (such as the laundress uses in washing). This will bleach any tooth that is stained by vegetable color. Now dry well and fill with such shade of oxide of zinc as will restore normal color. When hard cut out the surface and cover with gold. In case iron be the color agent, it may be removed by dissolving a few crystals of oxalic acid in the cavity; afterward proceed as before directed.

Faithfulness in following these instructions, the doctor says, will result in satisfaction to patient and practician, by perseverance.

NEW CORN GRATER.

We give herewith an engraving of an improved device for extracting pulp from green corn, recently patented by Mr Geo. Wood, 15 Warren street, Trenton, N. J. It is a very simple device, and it seems to be just what is needed for the purpose.

The curved upright metal standard is provided with jaws and a thumbscrew for securing it to the table, and supports at the top two parallel blades, one serrated, the other plain. These blades are made in one piece with the standard, and are slightly concaved to conform to the shape of the ear of corn.

The corn to be grated is moved across the blades, the toothed blade first tearing open the kernels and the plain one pressing out the pulp, which falls into the vessel below. The curved standard readily admits a bowl or dish under the blades, and the clamping screw holds the device steadily while in use.

This useful little instrument makes the operation of grating rapid and easy. The pulp obtained by this instrument

WOOD'S CORN GRATER.

is entirely free from hulls, and may be used in a great variety of dishes. The grater is tastefully and substantially made of galvanized or tinned malleable iron.

For further particulars address the inventor as above.

THE BABCOCK & WILCOX WATER TUBE BOILER.

[*Continued from first page.*]

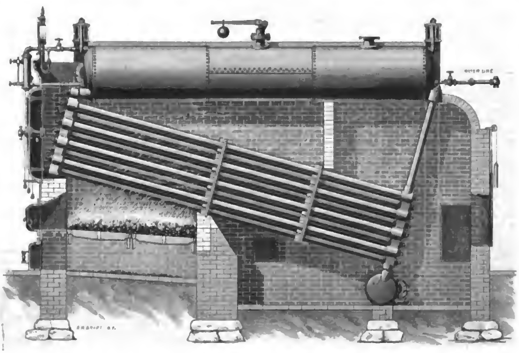
and the products of combustion pass up between the tubes into a combustion chamber under the steam and water drum; from there they pass down between the tubes, then once more up through the spaces between the tubes, and off to the chimney. The water inside the tubes, as it is heated, tends to rise toward the higher end, and as it is converted into steam—the mingled column of steam and water being of less specific gravity than the solid water at the back end of the boiler—rises through the vertical passages into the drum above the tubes, where the steam separates from the water, and the latter flows back to the rear and down again through the tubes, the circulation being perfect and constant. As the passages are all large and free, this circulation is very rapid, sweeping away the steam as fast as it is generated, and supplying its place with water, the heat of the fire is absorbed to the best advantage. There is a thorough circulation of the water throughout the boiler, and a consequent equalization of temperature; this prevents, to a great degree, the formation of deposits or incrustation upon the heating surfaces, carrying them away and depositing them in the mud drum, whence they are blown out in the usual way. The steam is taken out at the top of the steam drum near the back end of the boiler after it has thoroughly separated from the water.

Among the many advantages which accrue from this peculiar construction the following are most prominent: a thin heating surface in the furnace; joints removed from the direct action of the fire; a large draught area; complete combustion; a thorough absorption of the heat; an efficient circulation of water; rapid generation of dry steam; steadiness of water level; freedom from injurious effects of expansion; safety from explosion; accessibility for cleaning; ease of transportation.

The advantages here enumerated are not merely theoretical, but they have been actually demonstrated by the use of more than 35,000 horse power, extending over a period of twelve years, under a great variety of circumstances.

The Singer Manufacturing Company have forty of these boilers, Messrs. Matthiessen & Wiechers have twenty-five, and they are to be found in many of the largest sugar refineries and manufactories of all kinds in this and other countries, one concern having as many as 4,650 horse power in use.

The boiler fronts and the design and arrangement of the fixtures and fittings evince good taste and judgment, and are features which attract the attention of engineers and purchasers. Messrs. Babcock & Wilcox, of No. 30 Courtlandt St., New York, will furnish our readers with any further particulars.



SIDE ELEVATION OF THE BABCOCK & WILCOX WATER TUBE BOILER.

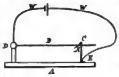
Heavy Damages for Patent Infringement.

In the suit of Christopher C. Campbell against Postmaster James, Charles Eddy, Horace T. Caswell, and Samuel R. Claxton to recover profits for the use of a patent invention in the New York Post Office for the cancellation of postage stamps and the stamping thereon of the date at one blow of the hand, Judge Wheeler in the United States Court has rendered a decision on the Master's report, mulcting Postmaster James in $63,000. This amount, the court finds, was saved in the expenses of the office by the use of the patented article, and such amount the plaintiff is entitled to as damages for the infringement of his patented rights. "The postmaster did this as such," the judge says, "but he was not obliged to do it. He could have refused the office, or resigned it, or have left this patent alone. He was not subject to any restraint, physical or moral, that he could not make subservient to his own choice. His choice was to use this invention and to make this gain. When made it belonged to the relator. Justice can only be done by requiring the defendant to restore the gains to those to whom they belong and leave him to be protected as the law provides, and in doing this no injustice will be done to any one." The judge concludes by ordering that a decree be entered that Postmaster James pay to the clerk of the court $63,000 within twenty days from the entry of the decree for the benefit of the other parties to the suit.—*N. Y. Evening Post.*

The Electrical Adhesion of Metal Contacts.

Workers with telegraph apparatus have often observed a sticking action between two metal contacts (such as the tongue of a "relay") across which a current of electricity is passing; but no experimental study of the phenomenon had, as far as we are aware, been made of the phenomenon till Mr. Stroh, the eminent mechanician, took it up. The results of his recent researches on this subject were recently communicated to the Society of Telegraph Engineers, when some exceedingly interesting experiments were shown by him.

The accompanying figure is a rough sketch of Mr. Stroh's apparatus for showing the adhesion. The metal contact, X, is formed at the crossing of a wire, B, which is supported at one end, D, and a bent wire, C, of the same or another metal, as the case may be. The current from a single bichromate cell is sent across the contact by connecting the poles of the cell by wires, W W, to the mercury contact cups, D E, connected to the wires; and A is a base board supporting the contact. The wire, B, is twelve inches long, and it ought to be fine enough to present a sharp point of contact to C. In fact, the most adhesive contact is formed by two knife-edges crossing one another. The contact must also be perfectly clean and polished. On pressing B against C with a very steady hand the passage of the current will cause the two to adhere together; and they will continue to adhere though the current be taken off. The rapid making and breaking of the current even does not dislodge B. At every make and break, however, a "click" is heard, which is louder on making than on breaking.



To measure the force of adhesion Mr. Stroh has constructed a modification of the above apparatus, in which the rod, B, is made into a kind of steelyard, along which a weight of German silver is slid until it pulls asunder the two contact edges which are stuck together by the current. These edges are beveled to angles of 45°, and they were made of different metals in order to get comparative results.

The following table shows the strength of the electric joint produced by the current from two bichromate cells of the ordinary globular form sold by instrument makers:

Contacts of	Sustained grammes.
Copper	0·16
Silver	0·15
Aluminum	2·5
Brass	8·6
Zinc	11·0
Tin	14
Gold	17
Lead	18
German silver	28
Platinum	42
Iron	65
Steel, soft	100
Steel, hard	225

It will be remarked that copper and silver contacts being the best conductors give the lowest adhesive force. This is explained by Mr. Stroh on the hypothesis that the sticking is due to a partial fusion and welding of the points of contact by heating due to the passage of the current. Copper and silver, offering little resistance to the passage of the current, are, therefore, very feebly heated or fused; hence there is only a slight adhesion. The adhesive power of the joint does not, however, strictly follow the relative resistances of the metals, owing probably to the metals being of different degrees of hardness; lead, for instance, being much softer in the contact edge than platinum, and, therefore, more liable to be flattened out by the shock of meeting. It is not so easy to account for the extraordinary difference between hard and soft steel, the latter supporting less than one-half the weight supported by the former.

There is little doubt, says *Engineering*, that welding is the true cause of this adhesion, for the microscope plainly shows the fused edges of the contact. The result of a continued application of the current seems to be a hardening of the contact, as if it were plunged in water or tempered. This effect naturally reminds us of Mr. Edison's experiments on the shrinkage and consequent hardening of wires by passing currents through them.

In concluding his observations Mr. Stroh drew attention to the fact that the adhesion was, perhaps, chiefly due to the breaking of the current, which was always attended by a spark. Mr. W. H. Preece remarked that if the current were interrupted often enough, the resulting clicks would merge themselves into a continuous hum; and alluded to the obvious connection between such a contact and the microphone.

Distinguishing Lights for Lighthouses.

In a letter to the London *Times*, Sir W. Thomson recommends: (1) A great quickening of all revolving lights. (2) The application of a group of dot-dash signals to every fixed light. (3) The abolition of color as a distinction for lighthouse lights, except for showing dangers, channels, and ports by red, white, and green sectors.

His proposal is to distinguish every fixed light by a rapid group of two or three dot-dash eclipses; the dot of about half a second duration, the dash three times as long, with intervals of light, about half a second each, between the eclipses of the group, and of five or six seconds between groups. The distinction by color alone ought to be prohibited for all lighthouse lights, on account of its liability to be confused with ships' and steamers' side-lights.

Of about one hundred and twenty revolving lights on the English, Scottish, and Irish coasts there are in all eighteen, in which the periods are ten seconds or less, and the times of extinction seven seconds or less. In these quick revolving lights, the place of the light is not practically lost during darkness; the eye, sweeping deliberately along the horizon, with or without the aid of a binocular, "to pick up the light," passes over less than its own field of view within the period of the light, and thus finds it almost as surely as if it were fixed.

A Case of Melanosis in Philadelphia.

For some months a Philadelphia physician has had under treatment an infant afflicted with the rare disease, melanosis, in an aggravated form. The child was born with a fair complexion, dark eyes, and brown hair. Soon after birth he began to turn dark of skin, the color deepening from yellow to saffron, and finally to black. The color was uniform all over the body, except at the joints where it was a little darker, and in the palms of the hands where it was lighter. The once brown hair grew stiff and jet black, and the eyes also grew darker, so that the line between the pupils and the iris could not be distinguished.

In spite of medical treatment the boy became worse, and grew very weak, all the time the color of his skin deepening. At last he became as black as a full blooded negro. Then he was attacked by convulsions, which grew more frequent and violent until they threatened the child's life. It was in one of these that Dr. Reynolds was called in. He succeeded in curing the spasms, and then devoted his attention to the strange disease which afflicted the child. He at once recognized it as melanosis or pigmentation, which is mentioned in the books in a general way, but there is no case given where it had developed all over the body. This was more than sixteen months ago, the child being then thirteen months old.

Since then the boy has greatly improved, by degrees becoming lighter, until now he is of a light chestnut brown color. The case has naturally attracted much attention from physicians.

THE COLUMBIA.

The new steamship Columbia, just completed at the works of John Roach, at Chester, Pa., for the Oregon Railway and Navigation Company, has been lying at the foot of Wall street in this city for the last few days, taking on cargo and receiving a few finishing touches prior to steaming to the waters for which she is intended. She will ply between San Francisco and Portland, Oregon, and is claimed by her owners to be in all her appointments and conveniences the finest steamship afloat: an opinion which her numerous visitors were generally inclined to accept as justified by fact.

The Columbia is 334 feet in length, 38½ feet beam, 23 feet in depth of hold, and 3,200 tons measurement. She is provided with compound engines, and is expected to make an average speed of fourteen knots. The principal officers are: Captain F. Bolles, First Officer De Wolf, Chief Engineer J. C. Henderson. We are indebted to the courtesy of the last named officer for much of the information here given.

The main dining room is of elegant proportions, with two guests' or communicating rooms at the after end. The interior is finished in hard woods—French walnut, Hungarian ash, and bird's-eye maple—each section being relieved by two small pilasters running up the entire height and finished with handsome mahogany capitals. The vessel is elegantly fitted throughout in the matter of carpets, furniture, and upholstery. Prominent among the newest features is the heating apparatus, consisting of a register in every room, supplied with air driven in by an engine and controlled by the occupant of the room. In hot weather it can be utilized for cold, and in cold weather for hot air, thus securing perfect ventilation and doing away with the disagreeable odor of steam heaters and leakage in the rooms. But the greatest innovation is the adoption of the Edison electric light throughout the ship, the Columbia being the pioneer in this great, and to passengers most agreeable improvement. These lights are maintained by four of Edison's dynamo machines in the engine room, arranged so that each line is under command of the engineer. The lights of the state rooms are under control of the steward on the outside. All of the rooms are fitted up with electric calls, and the offices, smoking room, etc., are provided with telephones—the smoking room being in connection with the steward's room, and the captain's with the chief engineer's, purser's, and steward's. Among other improvements are an electric telltale on the bridge, enabling the captain to tell, by simply pressing a button, whether the engine is going ahead or back, and at what speed, so as to prevent any accidents by mistaken signals from the bridge to the engine room. The steering gear has connection with the freight hoister, but with self-acting attachment. The elevators for discharging cargo are new in design, and the running engines at the ports are arranged so that a truck loaded with freight runs from the lower hold out to the dock entirely by steam.

The Maxim electric head light is of novel construction, and is supplied by a current from one of Maxim's dynamo machines placed between decks.

The four Edison machines are arranged along one side of the engine room, as shown in Fig. 2. One of them is a dynamo electric machine used in exciting the field magnets of the others. The several circuits extending from these machines are controlled by a switch board seen at the farther side of the engine room. The state rooms on the upper and lower decks are on separate circuits; so also are the saloons. This arrangement admits the employment of the light as a signal to indicate when the time approaches for extinguishing the lights altogether, by simply breaking the circuit for an instant ten minutes before the prescribed retiring hour.

Fig. 3 gives a good idea of one of the elegant state rooms provided with an Edison lamp pendent from the ceiling, and Fig. 7 shows the style of lamp adopted for the dining saloon; the lamps in the grand saloon are on the same general plan, differing a little only in form. The lamp fixture, as will be noticed, is of the same form as those used for oil lamps, and by an ingenious mechanical contrivance they are adapted to either the electric or oil lamp, so that should the electric lamp in any way fail the oil lamps may be immediately substituted. The electric lamp globes are frosted lightly by dipping them in hydrofluoric acid. The globe thus treated seems to increase the amount of light proceeding from the incandescent horse shoe carbons, so that by some they are credited with double the actual amount of light, while in reality one-twenty-third is absorbed by the globe.

There can be no question as to the quality or steadiness of the Edison light, this practical application of 120 lamps having settled that point. As to the economy of the system of lighting and the durability of the lamps Mr. Edison and his supporters do not hesitate to say that these points are sufficiently well established to insure commercial success. Certainly there is no place where a lamp of this character would be more desirable than on shipboard, where the apartments are necessarily limited in size and pure air is a matter of great consequence.

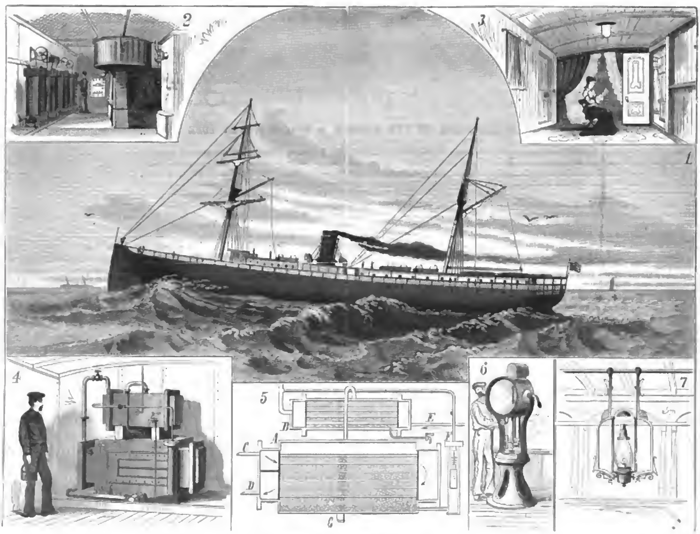
Among the marked improvement in state room fixtures we notice particularly the arrangement of the berths, which are similar to those of a Pullman Palace Car. When the berths are not in use they are folded out of the way, affording a cosy little room where one may enjoy the comforts or discomforts of a sea voyage in seclusion.

The system of water supply for fire and other purposes is most complete. Pipes lead to all parts of the vessel and terminate in lengths of hose conveniently placed, and in the pipes a constant water pressure is maintained on much the same plan as the well known Holly system of water supply; so that all that is necessary to obtain a copious discharge of water in any part of the ship is to open a valve. The still by which a constant supply of fresh water is maintained is new in its construction and arrangement. Fig. 4 shows the exterior, and Fig. 5 is a vertical longitudinal section showing the interior. The still, A, is traversed longitudinally by flues through which steam circulates, entering through the pipe, C, returning to the boiler through the pipe, D. The still, A, communicates with the condenser, B, by a pipe entering the top of the latter. The condenser is traversed lengthwise by tubes through which cool water passes, entering by the pipe E, and leaving by a vertical pipe at the opposite end. A portion of the water used in cooling the condenser is taken to the still through the float valve, F, which keeps the water at a uniform level. The still is provided with a blow-off, G, for clearing out the salt; it also has a surface blow-off. This apparatus is capable of supplying 1,200 gallons of pure fresh water daily.

In Fig. 6 is shown the electric head light, which consists of a Maxim electric lamp, having its arc in the focus of a parabolic reflector, which may be turned in any direction and a cone of light projected a long distance. When directed across the East River from its present position it illuminates the buildings in Brooklyn almost as brightly as sunlight. In building this magnificent steamer nothing seems to have been forgotten. It is as complete as the best engineering and inventive skill can make it. The engines are provided with independent air pumps and other important modern improvements. Everything has a symmetrical and finished appearance.

The cargo which she is taking on consists largely in railroad supplies, thirteen locomotives and 200 cars being included. On her way to her destination she will coal at Rio Janeiro, and while there will be exhibited to the Emperor Dom Pedro, who takes an especial interest in the progress of electric lighting.

Mr. John M. Bailey, of Winning Farm, Billerica, Mass., informs us that he is now (April 24) feeding his milch cows and ewes with lambs exclusively upon corn fodder ensilaged in September last. His silos were opened December 3, and the preservation of the fodder is as perfect now as then. Mr. Bailey is doing great service to the agricultural world in demonstrating to American farmers the advantages of this method of keeping fodder.



THE NEW STEAMSHIP COLUMBIA.

NATURAL HISTORY NOTES.

Automatic Movements of a Fern.—Dr. Asa Gray, in *Coulter's Gazette*, says: "Mr. E. J. Loomis, of the Nautical Almanac Office, Washington, recently showed me a phenomenon which, I suppose, has never before been noticed, and which is commended to the attention of botanists. A tuft of *Asplenium trichomanes*, gathered last autumn in the mountains of Virginia, is growing in his house, in a glass dish. About two months ago he noticed that one of the fronds—a rather short and erect one which is now showing fructification—made quick movements alternately back and forth, in the plane of the frond, through from 20° to 40°, whenever the vessel was brought from its shaded situation into sunlight or bright daylight. The movement was more extensive and rapid when the frond was younger. When I saw it on the 23d of January, its compass was within 15°, and was about as rapid as that of the leaflets of *Desmodium gyrans*. It was more rapid than the second hand of a watch, but with occasional stops in the course of each half vibration. This was in full daylight next a window, but not in sunshine. No movement had been observed in the other fronds, which were all sterile and reclining, with the exception of a single one which was just unfolding, in which Mr. Loomis thinks he has detected incipient motion of the same kind." This little fern is very common, and it is easy to obtain it and set it growing. The matter is worthy of further investigation.

Vitality of Mollusks.—Very extraordinary statements are found in the books regarding the vitality of shell fish. Dr. Woodward states that in June, 1850, a living pond mussel was sent to Mr. Gray, of the British Museum, from Australia, which had been more than a year out of water. The pond snails (*Ampullariæ*) have been found alive in logs of mahogany from Honduras; and M. Cailland carried some alive from Egypt to Paris packed in sawdust. Indeed, it is not easy to ascertain the limit of their endurance; for Mr. Laidlay, having placed a number in a drawer for this purpose, found them alive after five years, although in the warm climate of Calcutta. In the ordinary land snails such cases are still more remarkable. Some of the large tropical species of *Bulimus*, brought from Valparaiso by Lieut. Graves, revived after being packed, some for thirteen, others for twenty months. Mr. Wollaston had informed Dr. Woodward that specimens of two Madeira snails (*Helix papilio* and *tectiformis*) survived a fast and imprisonment in pill boxes of two years and a half, and that a large number of the small *H. turricola*, brought to England at the same time, were all living after having been inclosed in a dry bag for a year and a half. But the most interesting example of resuscitation occurred to a specimen of the Desert snail from Egypt, chronicled by Dr. Baird in the "Annals of Natural History." This snail was fixed to a tablet in the British Museum on the 25th of March, 1846; and on the 7th of March, 1850, it was observed that he must have come out of his shell in the interval (as the paper had been discolored apparently in his attempt to get away); but finding escape impossible, had again retired, closing his aperture with the usual glistening film. This led to his immersion in tepid water and marvelous recovery. Dr. S. Lockwood, in the *American Naturalist*, for March, adds another remarkable instance of vitality in the case of *Helix aspera*. He says: "August 24, 1878, I ascended an old castle, or square tower, near Queenstown, Ireland, and found between the stones a number of the common garden snail of Europe (*H. aspera*). I secured three specimens, and having wrapped them in paper, put them in my trunk. On my arrival home, October 28, on looking for my treasures, I found that one was crushed. The other two I dipped in water a few seconds, then put them in the fernery, and was delighted to see them crawl about. I could not get them to feed. One died in the following May, having been in confinement nine months. The other died in November, 1879, having lived thirteen months without food.

Recent Botanical Discoveries in America.—Prof. Eaton reports in the *Bulletin of the Torrey Botanical Club*, the discovery in Nova Scotia, by Miss Elizabeth G. Knight, of this city, of *Schizæa pusilla* and *Littorella lacustris*. The rare and interesting little fern, *Schizæa*, was only known before to occur in the pines of New Jersey, although Prof. Gray states that he has seen specimens of it in La Pylaie's herbarium at Paris, collected sixty years ago, and which are ticketed as having been detected in Newfoundland. The *Littorella* was found for the first time in America by Mr. Macoun, in 1869, on an island in Gulf Lake, Canada. It was found again by Mr. Pringle at the northern end of Lake Champlain, a short time only before Miss Knight found it in Nova Scotia; but these are the only records thus far of its discovery in America. Until these discoveries the plant, unlike most aquatics, had apparently a very restricted range of distribution, being confined chiefly to Central and Northern Europe, although not uncommon in many of the lakes and streams of Scotland, and occurring, though rarely, in England.

DUST FIGURES.

BY SETH NOBLE.

I was very much interested in reading the letters in Nos. 5 and 6 of the current volume, SCIENTIFIC AMERICAN, on crystallizations found in telescopic objectives, and was reminded that during ten years' use of surveying instruments I have always noticed this phenomenon in all old instruments which were exposed to very cold weather; I therefore attributed it entirely to freezing.

CURIOUS DUST FIGURES.

This subject has brought to my mind a very peculiar arrangement of dust particles found in a common water pitcher. This vessel was filled with water, and had stood near a window, unused, for about three months, during a portion of the spring and summer, in Kansas. In pouring the water out, my brother noticed the crystallized appearance of the dirt in the bottom, and carefully preserved the sediment and afterward photographed it. At that time (about eight or nine years ago) it attracted a good deal of attention, but none were able to explain the peculiar formation in a satisfactory manner, as no freezing weather occurred during the time the pitcher was standing.

A Many-Named Cereal.

Considerable attention has been called of late to an alleged new cereal, chiefly on account of the notice taken of it by the Kansas Board of Agriculture. Lately the Produce Exchange of this city received from California a specimen of the grain, with a communication with regard to it from an expert in cereals. The letter pronounced the grain no novelty, since it was cultivated in Europe as early as 1596.

It has been in the habit of coming forward every few years under a new name, having already been known successively as Egyptian corn, ivory wheat, Guinea corn, and Indian millet. Each attempt to foist it upon the public has been a clear case of false pretenses. It is really no other than the drooping sorghum (*Sorghum cernuum*), and differs from common sorghum principally in the fact that the stock bearing the head or ear droops. This is not caused by the weight of the ear, as the stalk begins to turn almost from the moment the ear begins to form. It is not rice or anything akin to it, and is not a native of South America. It has been repeatedly tried in all sections of the country, but has never succeeded in obtaining a foothold, because the American farmer will not be induced to accept it as a substitute for wheat, to which it is vastly inferior. Among the semi-barbarous peoples of the East Indies and Africa it forms a staple article of food, owing to the facility with which it can be prepared for the table. Unripe, it is cooked and eaten like green corn. Ripe, it can be boiled the same as rice. Flour is also made from it by crushing. It has abundant foliage of a grayish-green color, and grows to a height of seven feet, and a field of it consequently presents an odd appearance. The writer has nothing to say on the question of its adaptability to dry, arid sections where other cereals cannot grow. The specimen at the Exchange consists of an oblong bunch of grains about six inches long and three to four in diameter. The grains are about the shape of barley, but twice as large, ivory white with a black speck, and almost as hard as corn.

ANTS AND THEIR MILCH CATTLE.

The instincts of the ant are, indisputably, more extraordinary than those of any other in the whole range of animated nature. The ancients magnified them into fabulous miracles. Pliny talks of an Indian ant as big as an Egyptian wolf, of the color of a cat, which entered the bowels of the earth in search of gold, of which they are said to have been plundered during the winter by the human inhabitants of those regions. But exaggeration and credulity apart, the real habits and proceedings of these insects are so extraordinary that they would stagger our belief if not confirmed by the past observations of such naturalists as Huber and Latreille, and those of Sir John Lubbock and others of our own day. One of the most singular traits in their manners and customs is that of keeping and feeding certain other insects, from which they extract a sweet and nutritious liquid, in the same way as we obtain milk from cows. There are two kinds of insects from which the ant tribe abstract this juice—the aphides, or plant lice, and the gall insects. Linnæus, and after him other naturalists, have called these insects the milch cattle of the ants; and the term is not inapplicable. In the proper season, any person who may choose to take the trouble to watch their proceedings may see, as Linnæus says, the ants ascending trees that they may milk their cows, the aphides. The substance which is here called milk is a saccharine fluid, which these insects secrete, it is scarcely inferior to honey in sweetness, and issues in limpid drops from the body of the insect, by two little tubes placed one on each side just above the abdomen. (See engraving.) The aphides insert their suckers into the tender bark of a plant, and employ themselves incessantly in absorbing its sap, which, having passed through the digestive system of the insect, is discharged by the organs just mentioned. When no ants happen to be at hand to receive this treasure, the insects eject it to a distance by a jerking motion which at regular intervals they give their bodies. When the ants, however, are in attendance, they carefully watch the emission of the precious liquid, and immediately suck it down. The ants not only consume this fluid when voluntarily ejected by the aphides, but what is still more surprising, they know how to make them yield it at pleasure, or in other words, to milk them. On this occasion the antennæ of the ants discharge the same functions as the fingers of a milk maid; with these organs, moved very rapidly, they stroke the abdomen of an aphis first on one side and then on the other, and immediately a little drop of the much coveted juice issues forth, which the ant eagerly conveys to its mouth. A single aphis has been known to give it drop by drop successively to a number of ants that were waiting anxiously to receive it. The milk of one aphis having been exhausted, the ant proceeds to treat others in the same manner, until at length perfectly satiated, and with belly swelled almost to bursting, it lazily descends the plant and seeks its nest. A still more singular fact connected with this branch of the natural economy of these insects remains to be stated.

These cows are not always considered the common property of a whole tribe, but, on the contrary, some of them are appropriated to the exclusive use of the inhabitants of a particular hill or nest; and to keep these cows to themselves they exert all their skill and industry. Sometimes the aphides inhabiting the branches of a particular tree, or the stalks of a particular plant, are thus appropriated; and if any vagrant

ANTS AND THEIR MILCH CATTLE.

foreigners attempt to share this treasure with its true owners, the latter, exhibiting every symptom of uneasiness and anger, employ all their efforts to drive them away. Some species of ants go in search of these aphides on the vegetables where they feed; but there are others, such as the yellow ant, which collect a large herd of a kind of aphis, which derives its nutriment from the roots of grass and other plants.

These milch kine they remove from their native plants and domesticate in their habitations, affording, as Huber observes, an example of almost human industry and sagacity. On turning up the nest of the yellow ant this naturalist one day saw a variety of aphides either wandering about in the different chambers or attached to roots of plants which penetrated into the interior. The ants appeared to be extremely jealous of their stock of cattle; they followed them about and caressed them, whenever they wished for the honeyed juice, which the aphis never refused to yield. On the slightest appearance of danger they took them up in their mouths and gently removed them to a more sheltered and more secure spot. They dispute with other ants for them, and, in short, watch them as keenly as any pastoral people would guard the herds which form their wealth. Other species, which do not gather the aphides together in their own nest, still seem to look on them as private property; and, what is yet more extraordinary, they inclose them, as a farmer does his sheep, to preserve them not only from rival ants, but also from the natural enemies of the aphis. If the branch on which the aphides feed be conveniently situated the ants have recourse to a very effectual expedient to keep off all trespassers: they construct around the branch containing the aphides a tube of earth, or some other material, and in this inclosure, formed near the nest and generally communicating with it, they secure their cattle against all interlopers. The brown ant has been observed by Huber to build a chamber around the stem of a thistle in such a way that the stalk passed through the center, so that from their ant-hill they had only to climb the thistle stalk in order to enter this cattle-fold, which was suspended in mid-air. The interior, smooth and compact, was entirely formed of earth; it contained an extensive family of insect-cows, sheltered from the inclemencies of the weather, and protected from their enemies. These edifices are not always constructed near the bottom of the thistle stalk; Huber once saw one at a height of five feet from the ground. "These proceedings," says he, "are by no means common; we cannot attribute them to a habitual routine." Indeed, the modes of preserving their cattle seem to be as various as those practiced by man.

Some ants receive their food from the aphides which suck the juices of the common plantain, and these at first take their station near the flower of the plant; as soon as the flowers wither these insect-cows take shelter under the radicle leaves; whereupon the ants that before had climbed up to them now surrounded them with a mud wall, and, making a covered gallery by way of communication between their nest and the "paddock," extract food from them at their convenience and pleasure.

During autumn, winter, and spring many species of ants keep aphides. Indeed, in winter they would be exposed to the danger of famine did they not rely for food on their cattle; for though they become torpid when exposed to intense cold, yet, for the most part, the depth of their nests preserves a temperature for them sufficiently high to prevent this contingency. Their milch cows are then kept on the roots of the plants which penetrate the interior of the nest, and furnish an abundant supply of liquid, in which their keepers delight. And not only is the full grown animal kept, but its eggs are watched and guarded with that care which warrant us in supposing that the ant knows their full value. It is of real consequence to the ants that the hatching of the eggs of the aphides should take place as early in the spring as possible, in order to insure an early supply of food for their colony; and with the view of hastening this event they deposit them in the warmest part of their dwelling, and in fine weather bring them to the surface of the nest to give them the advantage of the sun.

Plant lice, or aphides, differ much in form, color, clothing, and in the length of the honey tubes. Some have these tubes quite long, as the rose louse (*Aphis rosæ*) of the accompanying engraving, which is green, and has a little conical projection, or stylet as it is called, at the extremity of the body between the two honey tubes. These insects seem to love society, and often herd together in dense masses, each one remaining fixed to the plant by means of its long tubular beak; and they rarely change their places till they have exhausted the first part attacked. The attitudes and manners of these little creatures are extremely amusing. When disturbed, like restive horses, they begin to kick and sprawl in the most ludicrous manner. They may be seen, at times, suspended by their beaks alone, and throwing up their legs as if in a high frolic, but too much engaged in sucking to withdraw their beaks. As they take in great quantities of sap they would soon become gorged if they did not get rid of it through the little tubes at the extremity of their bodies. When one of them gets running-over full it seems to communicate its uneasy sensations, by a kind of animal magnetism, to the whole flock, upon which they all, with one accord, jerk upward their bodies and eject a shower of the honeyed fluid. The leaves and bark of plants much infested by these insects are often completely sprinkled over with drops of this sticky fluid, and which on drying become dark colored, and greatly disfigure the foliage. This appearance has been styled "honey-dew," but should not be confounded with another similar production observable on plants after very dry weather, which has received the same name, and which consists of an extravasation or oozing of the sap from the leaves.

Snakes Eating Fish.

For a number of years past it has been my custom, because unable to find any better way to dispose of my summer leisure, to do a good deal of fishing in the Potomac river, sometimes in the immediate front of the city, sometimes at the Little and Big Falls above, and sometimes at the Four Mile Run below. I have generally used live bait, there being minnows in any quantity along the edges of the river. Three summers ago I went to catch minnows at the mouth of a small run called Gravelly Creek, situated on the west bank of the river, just at the foot of the Arlington estate. A short distance north of the run is the once quite celebrated Arlington Springs, which is still a place of resort for large numbers of Sunday visitors from the city. To reach the springs, except by boat, it is necessary to cross Gravelly Creek near its mouth, or go quite a long distance around the creek. To enable parties to cross the creek at the mouth, a passageway has been made by a kind of loose dam of stones. At low water the creek here is some forty feet wide, but at full tide it is fully sixty feet, and four or five feet deep. The loose stones form quite an impediment to the tide, so that, when the tide is rising, the water on the river side of the dam is several inches higher than the water on the other side, and flows through and over the loose stones quite rapidly, and the reverse is the case when the tide is falling. Vast numbers of minnows are to be found at all times in the marsh along the river banks, and as the tide rises they seek the runs to be found here and there to avoid the white and yellow perch which prey upon them, and it is while they are making up the creek that I catch the quantity I want.

One day, while catching minnows as usual, I noticed a number of snakes, the common water moccasin, approaching the dam or footway of stones. The water yet lacked several inches of reaching the top of the stoneway, although it was rushing in quite rapidly and carrying with it many bull-minnows and small white perch that were unable to resist it. Watching the snakes, I saw one after another reach the dam and take their station upon it, submerging themselves all but their heads, which were raised about an inch above the water and pointed in the direction of the incoming tide. In this position I counted seventeen snakes, arranged at uneven intervals, in a space of less than sixty feet. I came to the conclusion at once they were fishing, and watched them with a good deal of interest. Pretty soon I saw one head strike forward, going under the water, reappearing in a moment with a very large bull minnow in its mouth. The snake immediately loosened its hold upon the rocks and swam for the shore, reaching which it disappeared in the bushes; and this was repeated at intervals by each of the seventeen snakes. When they returned from the bushes, having made short work of their "catch," each snake sought his own particular location on the rocks, there being no clashing of interests there.

Now, how is this for reason or instinct? How do these snakes know where to locate themselves, and the particular stage of the tide at which to start on their fishing excursion? How do they know that a number of minnows will be swept over the miniature falls made by the rocks? These are questions that go beyond my comprehension, and I leave them for others to answer. But the facts remain, and any one who will take the trouble may verify them at any time during the summer by a visit to Gravelly Greek.—*Forest and Stream.*

Uses of the Potato.

In France farina is largely used for culinary purposes. The famed gravies, sauces, and soups of France are largely indebted for their excellence to that source, and its bread and pastry equally so, while a great deal of the so-called cognac, imported into England from France, is the product of the potato. Throughout Germany the same uses are common. In Poland the manufacture of spirits from the potato is a most extensive trade. "Stettin brandy," well known in commerce, is largely imported into England, and is sent from thence to many of her foreign possessions as the produce of the grape, and is placed on many a table of England as the same, while the fair ladies of our country perfume themselves with the spirit of potato, under the designation *eau de Cologne*. But there are other uses which this esculent is turned to abroad. After extracting the farina the pulp is manufactured into ornamental articles, such as picture frames, snuff boxes, and several descriptions of toys, and the water that runs from it in the process of manufacture is a most valuable scourer. For perfectly cleansing woolens and such like articles, it is the housewife's panacea, and if the washerwoman happens to have chilblains she becomes cured by the operation.

The Site for the Obelisk.

At a meeting of the New York Department of Parks, April 5, the site for the Egyptian obelisk, soon to be transshipped at Alexandria, was finally decided. It is to stand on a natural knoll in front of the new building of the Metropolitan Museum of Art, on the west side of the main carriage-way. This will add a new attraction to Central Park, and prevent the monolith from being dwarfed by surrounding buildings, as it would have been in any of the smaller parks or squares of the city.

Why is Arsenic a Poison?

The question of how arsenical compounds act as poisons has been discussed by Binz & Schulz as follows: Liebig seems to have been, up to the present time, the only author who had advanced any theory as to the poisonous action of arsenic. In the first edition of his work, that of 1843, on the relation of chemistry to agriculture and physiology, he states his views essentially as follows: Arsenious acid and corrosive sublimate possess in a high degree the power of forming with albumen solid compounds. When these substances are taken internally the albumen of the living tissues thereby loses the power of undergoing those transformations which are necessary to their existence. In this way the life of important parts is destroyed and the death of the whole being is the result.

Liebig did not afterward uphold this theory, although it is still to be found in some chemical handbooks. It has been abandoned for this reason, that a solution of arsenious acid, or of one of its salts, does not form the solid compounds (albuminates) as Liebig at first supposed, while this is undoubtedly the case with corrosive sublimate among others. There is, in fact, no single case known where arsenious acid produces any stronger precipitation of the constituents of the body than does carbonic acid for example.

This non-existence of an arsenical albuminate is also proven by the fact that an animal can be poisoned by the introduction of an arsenical solution without the spot where it was introduced, even if it is the extremely sensitive conjunctive of the eye, showing anything more than a slight redness. In the interior of the body, on the other hand, the changes are very clearly seen. The stomach is the central point of all these, even in cases where no trace of the poison has come into direct contact with it. Anatomical investigations show us that those very tissues of the body which are especially capable of taking up the oxygen of the blood are the furnaces of disturbances.

The neutral salts of arsenic acid are just as poisonous as those of the arsenious acid, and some say more so. Arsenious acid can readily be converted into arsenic acid, and the latter passes still more easily into the former. The latter process is aided by albumen in general; the former only by the *living* albumen of plants and animals.

The experiments were first made outside of the organism with single parts. White of egg and fibrin from warm-blooded animals were digested with arsenic acid at the temperature of the body, and were found to reduce it to arsenious acid; fresh brains do the same. The tissues of the digestive organs as well as the liver and the undecomposed protoplasm of plants not only reduced arsenic acid to arsenious acid, but also oxidized arsenious acid to arsenic acid. If the tissues which are able to oxidize the lower to the higher acid are previously heated in boiling water, they lose this property. Blood, hæmoglobin, and fresh fat, do not possess either one or the other action.

This double property can be proven in living animals. The two different oxides of arsenic are converted, the one into the other, by the lining of the intestines, which, in cases of poisoning, belong to those parts which are first and most violently affected. On the other hand, those parts which, in life, are touched, or only later and secondarily, are not able to start these changes, especially to oxidize arsenious acid.

Careful and accurate consideration of all the details of our experiments lead to the conclusion that the conversion and reconversion of these acids into one another in the animal body, as first proven by us, causes a violent vibration of the oxygen atoms in the molecules of living albumen, whereby the tissues are corroded until totally destroyed.

In this respect there is a perfect parallelism between nitrogen and phosphorus. Nitric oxide is excessively poisonous. By taking up oxygen it is converted into the violently oxidizing hyponitric acid. It destroys the tissues, while it is in part reconverted with absorption of water into nitric oxide. In the whole reaction the nitrogen takes no direct part. It is merely the inert carrier and distributer of the powerfully aggressive active oxygen atom. Arsenic plays the same rôle here, where it appears as the carrier of active oxygen, that is, it is every instant passing from arsenious acid to arsenic acid, and back again to arsenious acid.

The distinctions between arsenic and nitrogen are only gradual. The oxides of nitrogen attack the parts where they enter the organism; the oxides of arsenic at first envelop their activity within themselves, and it is only by long activity that they are recognized as corrosive without. The active oxygen of nitric oxide instantly tears itself loose, but that of arsenic acid requires some time, and that is the reason why the latter first shows its destructive effects within the organism. That such oxygen atoms possess poisonous properties is evident from the well-known poisonous action of ozone when it passes into the organism except in an exceedingly dilute form. This has recently been shown, too, in the case of chlorates. They give up their three atoms of oxygen to certain constituents of the body, being reduced to chlorides, and thereby act corrosive and destructive to the cells and the blood.

The other members of the nitrogen group show a remarkable coincidence both in their chemical and poisonous properties. Antimony, bismuth, and vanadium pass readily from one degree of oxidation to another. Phosphorus generates ozone in the body as well as in the air, and thus destroys the living albumen. The good effects of these as remedies can also be traced to the action of their active oxygen.—*B. d. d. Ch. Ges.*

THE CHRONOLOGY OF THE TELEGRAPH.

In his critical and laborious review of the origin and development of the electro-magnetic telegraph, with special reference to Professor Joseph Henry's contributions thereto, Mr. William B. Taylor has gone over the literature of this vast subject with great minuteness and thoroughness. We speak of the "development of the telegraph" designedly, and without reference to the world-embracing systems of telegraphic lines, for the record conclusively justifies the assertion of Robert Sabine that the electric telegraph had, properly speaking, no inventor. "It grew up little by little, each inventor adding his little to advance it toward perfection."

The more notable impulses and developments in this long evolution we propose to summarize, following Mr. Taylor throughout.

TELEGRAPHS BY ELECTRICITY.

1774.—Georges Louis Lesage, Geneva, set up the first telegraph line, which consisted of twenty-four insulated wires for the alphabet, each terminating in a pith-ball electroscope, duly lettered, for indicating by its excitation the succession of letters in the message, the transmitting operator using a manual conductor from an electrical machine.

1787.—Mons. Lomond, Paris, employed a single brass wire in connection with pith-ball electroscopes, making use of an alphabet of motions.

1794.—M. Reiser, Geneva, used thirty-six insulated wires for letters and numerals, in connection with a like number of narrow strips of tin foil pasted on glass; the letters and figures were cut in the foil and made visible by the passage of the electric spark.

1795.—Tiberius Cavallo, England, sent explosive and other electric signals through fine insulated copper wire, using Leyden jars, and sending "sparks at different intervals according to a settled plan."

1798.—D. F. Salva, Spain, worked an electric telegraph through the unprecedented distance of twenty-six miles, using a single wire, and the sparks of a Leyden jar for signals.

1816.—Francis Ronalds, England, constructed an experimental telegraph line, of a single insulated wire 8 miles long, operated by an electrical machine, or small Leyden jar. His elementary signal was the divergence of the pith balls of a Canton's electrometer, produced by the communication of a statical charge to the wire. Lettered dials, rotated synchronously at each end of the line, served, in connection with the pith-balls, to indicate the letter designated by the sender. This dial system was the precursor of Wheatstone's dial telegraph in 1839; House's letter printing telegraph in 1846; and Hughes' printing telegraph in 1855.

1828.—Harrison Gray Dyar, America, constructed a telegraph on Long Island, supporting his wires by glass insulators fixed on trees and poles; the electric signals printed themselves upon litmus paper, the spacing of the marks indicating the letters and other signs. Just as Dyar and his partner Brown were seeking capital to set up a line between New York and Philadelphia, a black-mailing agent, failing to extort the concession of a large share in the enterprise, obtained a writ against the two partners on a charge of conspiracy to carry a secret communication between the cities! The case was never brought to trial, but the enterprise was blocked.

According to Steinheil, these various experiments put it beyond a doubt that frictional electricity might be made a successful means of telegraphic intercourse.

TELEGRAPHS BY GALVANISM.

1808.—The first to apply to telegraphy the galvanic battery introduced by Volta, in 1800, was Dr. Samuel Thomas Von Soemmering, of Munich. He employed the energy of a powerful voltaic pile to bring about the decomposition of water by means of thirty-five gold pins immersed in an oblong glass trough. Each of these electrodes was in connection with one of the thirty-five wires forming the line. The bubbles evolved at these electrodes were received in lettered and figured tubes, and the messages were thus spelled out. In 1810 Soemmering telegraphed through two miles of wire.

1816.—Dr. John Redman Coxe, of Philadelphia, suggested a system substantially the same as Soemmering's (of which he appeared to be ignorant). He also proposed to accomplish the same result by decomposing metallic salts, as was afterwards done.

1843.—Mr. Robert Smith, Scotland, devised a galvano-chemical telegraph carrying out practically the suggestion of Dr. Coxe. At first he used a separate wire for each letter, the message being printed on a strip of paper wet with a solution of ferrocyanide of potassium. Subsequently Mr. Smith reduced his line to a single circuit of two wires, and worked his system through 1,800 yards of fence wire (1846).

1846.—Mr. Alexander Bain, Scotland, patented in England a galvano-chemical telegraph, different in mechanical details, but similar in its chemical record to the system of Smith.

1849.—Prof. Samuel F. B. Morse, New York, patented in this country a telegraph similar to Smith's.

TELEGRAPHS BY GALVANO-MAGNETISM.

1820.—Hans Christian Oersted, Copenhagen, rediscovered the directive influence of a galvanic conductor on a magnetic needle (Romagnosi's observations of the same in 1802 having attracted no attention). The same year (1820) Professor Schweigger, of Halle, made the first real galvanometer; and shortly after Ampère, in Paris, proved experimentally the feasibility of an electro-magnetic telegraph, in which the galvanometer should take the place of the electrometer employed by Lesage.

1823.—Baron Paul L. Schilling, of Cronstadt, Russia, practically applied Ampère's suggestion. In his apparatus signals were produced by five galvanometer needles, provided with independent circuits.

1824.—Peter Barlow, England, experimenting with considerable lengths of wire, to test the practicability of Ampère's suggestion, was convinced that it was impracticable, owing to the rapid diminution of effect (due to increased resistance), by lengthening the conducting wire. Other inconclusive experiments in the same direction were made by Fechner in 1829, and Ritchie in 1830.

1833.—Prof. Carl Friedrich Gauss and Wilhelm Edward Weber constructed at Gottingen a galvanometer telegraph of a single circuit of uninsulated wire a mile and a half long. The alphabet of signs was made up of right and left deflections of the needle, observed by reflections from a small mirror. Gauss was the first to employ magneto-electricity in telegraphs. Weber added to the signaling device a delicate apparatus for setting off a clock alarm.

1836.—Prof. C. A. Steinheil, of Munich, undertook, at the request of Gauss, the development of the arrangement above described, and constructed a similar galvanometer telegraph line two miles in length, introducing considerable improvements. The next year Steinheil discovered that the ground might be made a part of the circuit, thus dispensing with a second wire for the return circuit.

1837.—Mr. William Fothergill Cooke and Prof. Charles Wheatstone patented in England a galvanometer or needle telegraph very similar to the earlier one of Schilling, employing six wires and five indicating needles. An experimental line a mile and a quarter long was worked with partial success July 25; and one thirteen miles long was established in 1838.

While these experiments with the needle were going on the electro-magnet was being developed and applied.

1820.—The germ of the electro-magnet was discovered by Arago, who observed that the electric current would develop magnetic power in strips of iron and steel.

1824.—William Sturgeon, England, produced the true electro-magnet with its intermittent control of an armature.

The electro-magnet of Sturgeon was improved by Professor Henry in 1828; and in 1829 he exhibited a larger magnet of the same character, tightly wound with 35 feet of silk covered wire. A pair of small galvanic plates, which could be dipped into a tumbler of diluted acid, was soldered to the ends of the wire, and the whole mounted on a stand. This was the first magnetic spool or bobbin. This invention was further improved the same year, and in 1830 Professor Henry, assisted by Dr. Philip Ten Eyck, constructed an electro-magnet which lifted 750 pounds. In 1831 he made one weighing 82½ pounds, which sustained over a ton. In the meantime Professor Henry practically worked out the differing functions of quantity and intensity magnets, and experimentally established the conditions required for magnetizing iron at great distances through long conducting wires. This first made the electro-magnet available for telegraphic purposes.

1831.—The transmission of signals through a mile of copper bell wire interposed in a circuit between a small Cruickshank's battery and an intensity magnet—a practical telegraph—was practiced by Professor Henry.

"This memorable experimental telegraphic arrangement involved three very significant and important novelties. In the first place, it was the first electro-magnetic telegraph employing an 'intensity' magnet capable of being excited at very great distances from a suitable 'intensity' battery. . .

"In the second place, it was the first electro-magnetic telegraph employing the armature as a signaling device, or employing the *attractive* power of the intermittent magnet, as distinguished from the directive action of the galvanic circuit. That is to say, it was, strictly speaking, the first magnetic telegraph.

"In the third place, it was the first *acoustic* electro-magnetic telegraph."

Further on Mr. Taylor pertinently remarks that it is suggestive to consider how different would have been the popular estimate of Professor Henry's labors if he had been worldly-wise enough to secure an early patent on these three indisputably original and most pregnant features of telegraphy.

1837.—Professor Samuel F. B. Morse devised a magneto-electric telegraph capable of transmitting signals through a circuit of forty feet, but failed for longer distances from the circumstance that he used a quantity current. His friend, Dr. Gale, made for him an intensity battery, and added a hundred or more turns to the coil of wire around the poles of the magnet. With these necessary (and radical) improvements the apparatus was made to work through ten miles of wire. In applying for a caveat for his invention, October 6, 1837, Professor Morse specified six distinct parts, not one of which enters into the established "Morse" telegraph of to-day. Mr. Taylor shows that Professor Morse's real contribution to telegraphy consists first in the adaptation of the armature of a Henry electro-magnet to the purpose of a recording instrument; and second, in connection therewith, the improvement on the Gauss and Steinheil dual-sign alphabets, made by employing the single line dot and dash alphabet.

In his general summary of the history of the origin and development of the electro-magnetic telegraph, Mr. Taylor sets down the leading preparatory investigations and discoveries as these five:

1. The discovery of galvanic electricity by Galvani, 1786–1790.
2. The galvanic or voltaic battery by Volta, 1800.
3. The directive influence of the galvanic current on a magnetic needle by Romagnosi, 1802, and by Oersted, 1820.
4. The galvanometer by Schweigger, 1820 (the parent of the needle system).
5. The electro-magnet by Arago and Sturgeon, 1820–1825 (the parent of the magnet system).

The second half dozen capital steps in the evolution of telegraphy were:

1. Henry's most vital discovery, in 1829 and 1830, of the intensity magnet and its intimate relation to the intensity battery.
2. Gauss' improvement, in 1833 (or probably Schilling's, considerably earlier), of reducing the electric conductors to a single circuit by the ingenious application of a dual sign, so combined as to produce a true alphabet. (The anticipations of this idea by Lomond in 1787, Cavallo in 1795, and Dyar in 1825, are not regarded as practically influential in the progress of telegraphy.)
3. Weber's discovery, in 1833, that the conducting wires of an electric telegraph could be carried through the air, without insulation, except at the points of support.
4. As a valuable adjunct to telegraphy, Daniell's invention of a constant galvanic battery in 1836.
5. Steinheil's discovery, in 1837, that a single conducting wire is sufficient for telegraphic purposes.
6. Morse's adaptation of the armature of a Henry electro-magnet as a recording instrument, 1837, and the single line dot and dash alphabet in 1838.

The earlier needle type of electro-magnetic telegraph has found its special application in ocean lines, no element of the Morse system entering into the operation of submarine cables.

The more recent telegraphic developments do not fall within the scope of Mr. Taylor's review. A few other dates, as given by Prescott, may appropriately serve to complete this chronology.

1861.—Reiss discovered that a vibrating diaphragm could be actuated by the voice so as to cause the pitch and rhythm of vocal sounds to be transmitted to a distance and reproduced by electro-magnetism.

1872.—Stearns perfected a duplex system, whereby two communications could be simultaneously transmitted over one wire.

1874.—Edison's quadruplex system was invented.

1874.—Gray invented a method of electrical transmission, by means of which the intensity of tones as well as their pitch and rhythm could be reproduced at a distance; and subsequently conceived the idea of controlling the formation of electric waves by means of the vibrations of a diaphragm capable of responding to all the tones of the human voice.

1876—Telephone invented.—Bell invented an improvement in the apparatus for the transmission and reproduction of articulate speech, in which magneto-electric currents were superposed upon a voltaic circuit, and actuated an iron diaphragm attached to a soft iron magnet. During the same year Dolbear conceived the idea of using permanent magnets in place of the electro-magnets and battery previously employed, and of using the same instrument for both sending and receiving.

1877.—Edison's carbon telephone was brought out.

To these may be added Edison's electro-motograph, or electro-chemical telephone, 1877.

1878.—Duplexing of ocean telegraph.

1879.—Cowper's writing telegraph.

1880.—Field's successful substitution of dynamo-electricity for galvanic batteries in telegraphing.

Another Comet.

Capt. A. H. Markham, R. N., of H. M. S. Triumph, the flagship on the Pacific Station, reports that a comet was observed during the voyage from Payta in Peru, to Manta on the coast of Ecuador. The Triumph left Payta on February 7. The comet was first seen on the evening of the 7th at about 8 o'clock. The nucleus was distinctly made out, bearing southwest at an altitude of 7° above the horizon. The tail, a long spreading one, was not very brilliant, but could be clearly traced to an altitude of 35°, the observed termination bearing about south-southwest. The whole phenomenon subtended an angle with the horizon of about 70°. It was situated in the constellation of Argo Navis, and the direction of the tail was in a line almost equidistant between Sirius and Canopus. It set at about 9:30 P.M.

On the next evening it was again seen at about 8 P.M., but nearer the horizon, which proved that it had been traveling with extraordinary rapidity. Although the nucleus was closer to the horizon than on the preceding evening, the altitude of the end of the tail was 40°, showing that it had increased in size. Clouds banking up to the southward prevented Capt. Markham from observing the time of setting. On the 9th, the third evening of observation, it was very hazy, but the tail could still be seen, resembling the streamer of an aurora, in the same position as on the two previous evenings. At the same time a bright luminous patch was observed immediately under Canopus.

ACID PROOF CEMENT.—Make a concentrated solution of silicate of soda, and form a paste with powdered glass. This simple mixture is said to be invaluable in the operations of the laboratory where a luting is required to resist the action of acid fumes.

MISCELLANEOUS INVENTIONS.

An improved process of securing moulded glass stones to metallic frames has been patented by Mr. Johann Fischer, of Tannwald, Bohemia, Austria. The invention consists in attaching a thin metal plate to the under side of the moulded glass stone when the same is in a soft state, and then soldering this plate on the under side of the stone to the metal frame or plate of ornaments, jewelry, etc.

Mr. Paolo Corvaja, of Palermo, Sicily, Italy, has patented improvements in the method and apparatus for ballasting ships in port. The present mode of outside ballasting consists in hanging logs of wood by chains or ropes from the sides of the vessel as counter-balancing weights, so that when the vessel attempts to keel over from any cause while lying at the wharf or being towed, the weight of the log on the higher side alone prevents her from doing so, for on the lower side the slackening of the chains or ropes lets the log on this side float in the water; hence it is of no use, and the strain of righting the vessel is thrown entirely on one side. This arrangement also fails in its purpose of keeping the vessel steady, as when she rolls the log sinking in the water relieves her of its weight, whereby an unsteady motion is maintained. The object of this invention is to temporarily ballast ships by the weight and buoyancy of the ballasting logs combined.

In an improved stove, invented by Mr. Dabney L. Ervin, of Crawfordsville, Miss., the novel feature consists in arranging the binding rods of the stove in vertical grooves made in the edges of the side and back plates, so that they may be protected from burning; also in a peculiarly constructed soot drawer and scraper combined; and in an ash pan secured in position in a novel manner.

Mr. Henry R. Robbins, of Baltimore, Md., has patented a means for enabling the driver to make change for the passengers or deliver tickets to them without requiring the passengers to pass to the end of the car; and to this end it consists in combining with a street car two or more pneumatic tubes opening through doors at different points in the length of the car, and at the front end opening near the driver, together with suitable carriers for traversing the said tubes with the money or tickets, and an air forcing apparatus and a valve for directing the current through any one of said tubes, whereby the transmission of tickets or change is easily effected as between the driver and passenger.

Mr. Benjamin F. Luce, of Janesville, Minn., has patented an improvement in the class of laterally swinging gates having hinges or hinge attachments consisting of a roller and an inclined plane resting thereon, the two co-operating in such a manner as to render the gates self-closing.

A target and target stand, to be used in archery, lighter and more durable than those now in use, and possessing the advantage over others of stopping the arrows and allowing them to be easily withdrawn and without injury, has been patented by Mr. William A. Tangeman, of Lockland, Ohio.

In the ordinary connection between the governor and its valve the sliding action and free movement of the governor valve necessary to allow it to be sensitively acted upon by the governor permits such a leakage of steam as prevents the positive and reliable effect of the governor. Mr. Cyrus B. Cook, of Cynthiana, Ky., has patented an invention consisting in combining with the ordinary screw steam throttle valve devices whereby the engine is made to act upon its throttle valve to positively open or close the same, according to the requirement of the work.

An improved cut off for steam engines has been patented by Mr. William Redmond, of Greenville, S. C. The inventor makes use of a rocking lever connected with the valves and with the eccentric rod. The connection with the eccentric rod is made by a block that is fitted for movement in the rocking lever to and from the fulcrum thereof, and is positioned by connections from a speed governor, so that as the governor balls rise a quicker movement is given to the valves and the reverse as the balls fall.

RECENT DECISIONS RELATING TO PATENTS.

Circuit Court of the United States.—District of Vermont.—Wheeler, J.

AN INJUNCTION THAT PROHIBITS THE USE OF AN ARTICLE AFTER THE PATENT HAS EXPIRED.

American Diamond Rock Boring Company vs. Charles Sheldon, Charles H. Sheldon, John A. Sheldon, Charles H. Slason. In equity. February term, 1880.

A motion for a rehearing has been filed since the decree for an injunction and an account, in support of which counsel for the defendants have submitted a brief; and a motion to restore the injunction as to machines made during the life of the patent infringing upon it has been heard.

The motion for a rehearing rests entirely upon the ground that the decision made is, as is alleged for many reasons, erroneous, and is supported by the certificate of two counsel.

The English practice of granting a rehearing upon the certificate of two counsel as a matter of course does not prevail in the federal courts of this country. *Brown vs. Aspden*, 14 How. 25; *U. S. vs. Wright's Admr.*, 1 Black, 489; *Public Schools vs. Walker*, 9 Wall. 603. According to the present practice in this court the granting such motion rests in the sound discretion of the judges who have heard the cause or made the decision. This seems to be the general practice in the circuit courts of the United States. *Daniels vs. Mitchell*, 1 Story, 198; *Jenkins vs. Eldridge*, 3 Story, 299. This is all that is claimed by counsel for the defendants.

The brief has been carefully examined and it presents scarcely anything not before presented by counsel and fully considered. The validity of the reissued patent was established by Judge Shipman upon substantially the same record in the Southern District of New York. *Am. Dia. Rock Boring Co. vs. Sullivan Machine Co.*, 14 Blatchf., 119.

That decision was followed and concurred in in this case, and the decision in that respect could not be changed in this case without overruling that as well as the one in this case. The only other questions are those relating to infringement and to the effect of the New Hampshire decree. The question of infringement by the means held to be an infringement in this case was not determined by Judge Shipman in either case before him. It was merely postponed to final hearing; so that question was fully open. It was very carefully considered, and nothing new is presented in regard to it.

It seemed to be understood or assumed that the patent has been held to cover a conical boring head; but that is not correct. It has been merely held that filling into the center to make a conical head to bore by the same means as the annular head infringes the patent for the annular head, although it may be and probably is an improvement upon the annular head. And likewise in regard to filling out the stock even with the laterally projecting diamonds.

And there is nothing new about the New Hampshire decree. The fact remains that the causes of action there were different from those here, so they had not passed under judgment. And the issue here is not shown to have been actually decided by the court there relating to the merits of either case.

It is urged that the plaintiff does not proceed to an accounting under the decree so that the defendants can appeal. This motion, however, was filed before there was any time for such accounting, and its pendency may have thus far prevented. Whether it has or not, that is no ground for a rehearing, although it might become a ground for dismissing the bill for want of prosecution.

On the whole it is quite apparent that a rehearing under the rules would not, with any reasonable degree of probability, change the result, but would only delay this and other causes, and add to the expense of the parties.

The patent was granted under the acts of Congress of 1836 and 1861, and carried the full and exclusive right and liberty of making, using, and vending to others to be used, the patented invention during the term of the patent. Act of 1836, section 5. The defendants have machines made during the term of the patent, and which were infringements when made. If they could be made then and used now in defiance of the owner of the patent the exclusive right granted would not be fully enjoyed. The grant of the exclusive right is substantially the same in this country as it is in England. The question raised here arose there in *Crossly vs. Derby Gaslight Co.*, Webst. Pat. Cas., 119. The case is more fully reported in 4 Law Jour. N. S. Chan., 25. There the patent would expire on the 9th December, 1829, and on the 28th November, before a bill was filed praying for an injunction against using infringing machines and for an account, the Vice Chancellor granted the injunction and directed the account, and the defendants appealed. After argument, the Lord Chancellor Lyndhurst, said: "This is an appeal from his Honor the Vice Chancellor, and is a case for an injunction against the invasion of a patent right, by preventing the use of certain gas meters. This case is very peculiar, and is distinguishable from all other cases in the books. It appears that the plaintiff obtained his patent on the 9th of December, 1815, and that on the 28th of November, 1829, only a few days before the patent expired, he filed a bill. It was objected that the court would not interfere just on the eve of the expiration of the patent and grant an injunction which would only last a week. The point has never yet been decided; but I am of opinion that the court would interfere after a patent has expired to restrain the sale of articles manufactured previous to its expiration in infringement of a patent right; and that a party would not be allowed to prepare for the expiration of a patent by illegally manufacturing articles and immediately after its expiration to deluge its markets with the products of his piracy, and thus reaping the reward of his improbous labor in making it. The court would, I say, in such case restrain him from selling them even after the expiration of the patent." This doctrine does not appear to have been denied or questioned afterward, and was frequently carried out in effect by decreeing the destruction of infringing machines. *Betts vs. De Vitre*, 34 Law Jour. Chan., 289; *Needham vs. Oxley*, 11 Weekly Rep., 852.

In Curtis on Pat., Sec. 436, it is laid down as clear law that "if the patent has expired, the account and the injunction will extend to all the articles piratically made during the existence of the patent, though some of them may remain unsold." The illegality attaches to the things themselves. The person making them has no right to make them, no right to them when made; he can impart none, and none can accrue by their passing into time when they might be made. The ordinary injunction in such cases in effect restrains all infringement of the patent, and is in form perpetual. It would doubtless cover an illegal sale or use after the expiration of the patent. In this case the ordinary injunction has been suspended in the course of the proceedings to limit the term of the patent, and there is, therefore, no injunction now in force.

The injunction is restored as to machines made in infringement of the patent.

THE VOLATILE OIL OF MUSTARD.

BY WM. L. DUDLEY, PROFESSOR OF ANALYTICAL CHEMISTRY AND TOXICOLOGY, MIAMI MEDICAL COLLEGE OF CINCINNATI, O.

When the flour of black mustard, after having been freed from the fixed oil by pressure, is macerated for several hours with water and then distilled it yields 0·5 to 0·7 per cent of of a very pungent volatile oil. This compound has the properties and composition of the sulphocyanate of allyl, $C_4H_5NS = \left.\begin{matrix}(CS)\\(C_3H_5)'\end{matrix}\right\}N$. Its most characteristic reaction is its combination with ammonia, with which it unites immediately, forming crystalline thiosinnamine or sulphocyanate of allyl-ammonium, $H_4(C_3H_5)N.CNS$.

This volatile oil does not pre-exist in the seed of black mustard, but is formed from myronic acid contained therein, under the influence of water and a peculiar ferment called myrosin, which also exists there. Consequently it is not produced unless the mustard flour is allowed to macerate with the water some time before distillation. The myrosin of black mustard being limited in quantity, the best yield of the oil is obtained by mixing the seeds of the white and black mustard. White mustard seeds contain no myronic acid, consequently it is impossible to obtain the volatile oil of mustard from that alone.

The oil is colorless or slightly yellow; its boiling point is 148° C., and specific gravity 1·009 to 1·010; it is somewhat soluble in water, but dissolves easily in alcohol and ether. It has a very pungent and acrid odor and taste. It prevents the coagulation of serum albumen as well as alcoholic fermentation.

Oil of mustard is occasionally prepared artificially by distilling sulphate or iodide of allyl with potassium sulphocyanate. The following is an analysis by Dr. E. Mylius of a sample artificially prepared: Allyl sulphocyanide, 92·2 per cent; carbon bisulphide, 0·8 per cent; hydrocyanic acid, 0·2 per cent; polysulphides (chiefly allyl-trisulphide), 4·0 per cent; and non-volatile bodies containing nitrogen and sulphur, 3·0 per cent.

This oil has been used in medicine, chiefly externally, for its powerful rubefacient properties, blistering the skin when applied to it. Schwalbe (Deut. Chem. Ges. Ber. v. 286) says the addition of mustard oil to cow's milk (1 drop to 20 grammes) prevents coagulation. The mixture may be kept in summer for weeks in half filled bottles without coagulating; but after five or seven weeks the casein was found to be converted into albumen, and the liquid was strongly acid. According to Mitscherlich it is the most deadly of all ethereal oils, 4 grammes killing a kitten in two hours, 15 grammes in a quarter of an hour. The *post-mortem* appearances were those of acute gastro-enteritis, and the smell of the oil pervaded the blood, urine and lungs.

The commercial oil is much adulterated with alcohol, carbon bisulphide, petroleum spirit, oil of gilliflowers, and castor oil. Its purity can be tested very easily in the following manner: If several drops are allowed to fall on water they should sink to the bottom on very slight agitation, and should remain perfectly clear. A slight admixture of petroleum spirit causes the drops to remain on the surface. If the oil contains 5 per cent of strong alcohol the drops will become opalescent. Five drops of the pure oil of mustard dissolve in fifty of strong sulphuric acid to a clear deep yellow liquid; if it is adulterated with other vegetable oils they will become charred, and the solution will be dark brown or black; but carbon bisulphide, if present, will separate in minute drops and render the liquid turbid.

The Wheat Crop of the World.

The wheat crop of the whole world for 1879 shows a deficiency of over 375,000,000 bushels, nearly 200,000,000 bushels of the deficiency falling to Europe. The following table, compiled from the *Bulletin des Halles et Marchés*, shows the yield for each large wheat raising country compared with the average yield:

	Average yield. Bushels.	Yield for 1879. Bushels.
United States	337,500,000	367,500,000
France	280,172,000	172,105,000
Russia	190,000,000	157,500,000
Germany	99,000,000	90,000,000
Spain	94,500,000	78,750,000
Italy	87,500,000	67,500,000
Austria Hungary	79,500,000	68,000,000
Great Britain	88,500,000	47,500,000
Turkey	34,500,000	29,500,000
Roumania	27,000,000	22,500,000
Belgium	19,150,000	14,650,000
Portugal	6,750,000	5,675,000
Algeria	20,500,000	16,875,000
Canada	13,500,000	13,200,000
Australia	13,500,000	14,650,000
Egypt	13,500,000	11,500,000
Netherlands	4,615,000	3,372,000
Greece	3,500,000	3,375,000
Servia	6,375,000	3,812,500
Denmark	3,250,000	3,200,000

The Export Trade in Oysters.

The rapid increase in the exportation of oysters to Europe during recent years is shown by the following figures, as given by the Bureau of Statistics:

	Barrels.	Value.
1876	42,889	$214,196
1877	56,134	290,020
1878	79,812	361,061
1879	90,063	453,306
Totals	264,898	$1,321,383

During the winter just past the shipments have been much greater than during the corresponding weeks of 1878–79. The oysters are shipped in barrels on steamers, and generally arrive in good condition. The great bulk of them goes to England. Those sent to the Continent go almost exclusively to Amsterdam.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.
☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Lubricene, Gear Grease, Cylinder and Machinery Oils. E. J. Chard, 6 Burling Slip, New York.

OFFICE OF THE HALDEMAN PAPER COMPANY, LOCKLAND, O., April 30, 1880.
H. W. Johns M'f'g Co., New York:
GENTLEMEN: In the year 1873 we built a warehouse, 50 x 100, which we covered with your Asbestos Roofing. We have coated it with your roof coating once since it was first applied, and to all appearances it is as good today as when first put on. We were so much pleased with this warehouse roof that when we built a new mill, in 1877 we covered it with your Asbestos Roofing. This mill roof has been much admired by all who have seen it and taken the trouble to examine it. It has stood the test of the extremes of weather—two summers' heat and two winters' cold—and resisted all the storms to which it has been exposed. To-day it is in prime condition, and with ordinary care we see no reason why it should not continue to be a good roof for twenty years.
Yours very truly, J. C. RICHARDSON, Pres.

For Sale.—4½ inch refr. Telescope Prism, 4 eyepieces and tripod. Price, $160. H. M. Holbrook, Jersey City, N.J.

Machinery Salesman Wanted.—One who thoroughly understands and can sell Iron and Wood Working Tools. Address T. S. & A. J. Kirkwood, Chicago, Ill.

Wanted—Situation as Foreman or Superintendent of Foundry and Machine Works. Address Box 66, Toledo, O.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Wanted, by a Steam Heating Engineer, situation as Superintendent or Outside Foreman; 20 years' experience; will accept a percentage on profits as part pay; present engagement expires June 1. Address Wm. J. Baldwin, M. E., Elmira, N. Y.

Blake's Belt Studs are the best and cheapest fastening for leather and rubber belts. Greene, Tweed & Co., 118 Chambers St., New York.

Steel Figures, $1; Letters, $2 a set. York & Smith, Cleveland, Ohio.

Wanted—A Machinist. One who has wrought at Carriage Hardware Manufacturing, and is fully able to construct the dies and tools necessary for such goods. Address, with references, George Gillies, Gananoque, Ontario, Canada.

For the best Brick Moulds made in country, address D. J. C. Arnold, New London, Ohio.

Alcott Lathes with Nulling Attachment. Wm. Scott, Binghamton, N. Y.

For the Development of New Ideas, try Anderson Bros., Peekskill, N. Y. Experience large.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Geared Power Press, cost $450, for $200. York & Smith, Cleveland, Ohio.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 284.

Power, Foot, & Hand Presses for Metal Workers. Moderate prices. Peerless Punch & Shear Co., 52 Dey St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

25 H. P. Engines, complete order, $150. York & Smith, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N. J.

Walrus Leather and Walrus Wheels for Polishing all kinds of Metals. Greene, Tweed & Co., 118 Chambers St., New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 300.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave., Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 284.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Small High Speed Steam Yachts complete or in parts. Geo. F. Shedd, Waltham, Mass.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 300.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 49 and 50 Astor House, New York.

Blake "Lion and Eagle" Imp'd Crusher. See p. 301.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 301.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 317.

Peck's Patent Drop Press. See adv., page 301.

4 to 40 H. P. Steam Engines. See adv. p. 285.

Forsaith & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

$400 Vertical Engine, 30 H. P. See page 316.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

For Standard Turbine, see last or next number.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Wanted—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 Illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 10 cents per pound. Fully warranted.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 316.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 316.

For Separators, Farm & Vertical Engines, see adv. p. 316.

The Horton Lathe Chucks; prices reduced 25 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

For Patent Shapers and Planers, see ills. adv. p. 316.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 174.

The 1880 Pennsylvania Lawn Mower,—Light draught and easily adjusted. Machines warranted. See illus. adv. last week. Lloyd, Supplee & Walton, Philadelphia, Pa.

Send stamp for Illustrated Descriptive Price List of the Step Ladder, Ironing Table, and Clothes Drier. An ingenious combination. Useful in hotels, laundries, and every household, in every climate. See description in No. 13, Vol. 42, SCIENTIFIC AMERICAN. J. H. Martin, Hartford, New York.

Patent Steam Cranes. See illus. adv., page 316.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

For Power Paper, Lard, Cider Presses, see adv. p. 316.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 317.

Combined Universal Concentric or Eccentric and Independent Jaw Chucks. Pratt & Whitney Co., H'tf'd, Ct.

For Wood-Working Machinery, see illus. adv. p. 316.

C. J. Pitt & Co., Show Case Manufacturers, 230 Canal St., New York. Orders promptly attended to. Send for illustrated catalogue with prices.

For Middlings, Mill and Mill Furnishing, see adv. p. 316.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 317.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Mackenzie Cupola and Blower. The very best apparatus for melting iron, and with water bosh for smelting lead, silver, or copper ores. Send for pamphlet. Smith & Sayre Manuf. Co., 31 Courtlandt St., New York.

Penfield (Pulley) Block Works. See illus. adv. p. 316.

NEW BOOKS AND PUBLICATIONS.

THE FOOD OF BIRDS. THE THRUSH FAMILY. By S. A. Forbes. From Trans. Ill. State Horticultural Society. Vol. XIII. 1879.

The thrush family in Illinois embraces nine species: the robin, the cat bird, the brown thrush, the wood thrush, the hermit thrush, Swainson's thrush, the Alice thrush, the mocking bird and Wilson's thrush, of which the first three are most numerous and important. From an examination of the stomachs of 149 specimens of the family, shot in all months from March to September, Mr. Forbes has endeavored to determine the food of these birds and the probable effects of their foraging. Other species of birds will be studied in like manner during the coming seasons. The line of investigation thus marked out is a promising one; but much more information will have to be gathered before any trustworthy deductions can be drawn touching the relative economical value of the different species.

SEVENTH ANNUAL REPORT OF THE PROGRESS OF THE TOPOGRAPHICAL SURVEY OF THE ADIRONDACK REGION OF NEW YORK. By Verplanck Colvin. Albany, 1880.

In addition to a statement of the work of the survey during the year 1879, this volume gives a condensation of the reports for 1874, '75, '76, '77, and '78, with late results in geodetic and trigonometrical measurements, magnetic variation, hydrography, river surveys, leveling and barometric hypsometry, meteorology, rainfalls, botany, zoology, and geology, with many maps, engravings, and chromo-lithographs.

OFFICIAL REPORTS, ETC.

The following named reports of various governmental departments, societies, and so on, have been recently received:

Report of the Director of the Central Park Menagerie, Department of Public Parks, city of New York, for 1879.

Reports for 1878 and 1880, New York Meteorological Observatory, Central Park, New York. Daniel Draper, director.

Union League Club; Report on the subject of the Water Supply of New York. 1880.

Thirty-first Annual Report of the Trustees of Astor Library, for the year ending December 31, 1879.

Report of the Special Committee of the Chamber of Commerce of the State of New York on Railroad Transportation, 1880.

Geological Survey of New Jersey. Annual report for 1879. George H. Cook, State Geologist. Trenton: W. S. Sharp.

First Report of the Superintendent and Secretary of the Burlington Waterworks, Burlington, Iowa, 1880. Ira A. Holly, Superintendent.

The Northern Water Route; Lake Superior to the Red River of the North. Resolutions adopted by the Chamber of Commerce, Duluth, Minnesota, February 28, 1880.

United States Government Reports, Washington, D. C.

Annual Report of the Operations of the United States Life Saving Service for the year ending June 30, 1879.

Army Register for January, 1880.

Report of a Board of United States Naval Engineers on the Herreshoff Boiler and System of Machinery for Steam Yachts, etc. Navy Department, December, 1879.

Annual Report of the Chief of Ordnance for the Fiscal year 1879.

PRACTICAL HINTS ON MILL BUILDING. By R. James Abernathey. Moline, Ill.: R. James Abernathey. 8vo, cl., pp. 298. Price $4.

A plain, simple, practical, and sensible treatise on flour milling and the building of flour mills, apparently designed with special reference to the needs of young millwrights who, without being either machinists or carpenters, must have a working knowledge of much that belongs to both those trades as well as a practical knowledge of the construction and use of the various apparatus used in flour mills. The author has calculated several new tables on gearing, belting, and shafting, and has added much other tabular matter likely to be useful to all classes of mechanics and manufacturers.

POCKET MINING ATLAS. Compiled by Edwin Bolitho. New York: *Engineering and Mining Journal.* 1880.

A handy pocket atlas, showing on twenty-eight maps the principal mining districts and the location of the chief mines of the United States. The new mining districts of Colorado are given with especial fullness.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) F. H. S. asks: 1. Can I make a black aniline ink for working the new copying process? If so, please give formula. A. There is no satisfactory black. 2. What grade of aniline is used for the darkest violet inks? A. 4 B to 5 B methyl violet.

(2) W. S. R. asks for information in regard to making cast iron bells by mixing the material with the iron in the ladle, so it will not interfere with the balance of the iron in the cupola; and also, do you know of a cheap liquid bronze for bronzing bells or cast iron? A. To increase the hardness and sonorous qualities of the metal it is essential that the additions (of manganese or titanium) should be made in such a way that their thorough fusion and diffusion throughout the mass of metal should be effected; otherwise a non-homogeneous or brittle casting is apt to result. The mixing cannot be done in a ladle. For a bronze a mixture of coarse gold bronze in thin copal or amber varnish may be employed.

(3) G. F. C. asks: What kind of liquid or sizing is best to mix with ordinary bronze for painting iron wire, etc.? A. Common stopping or filling varnish will answer in some cases; gold size is best.

(4) T. M. H. asks how to oxidize iron wire to look like black japanning. A. We know of no way of "oxidizing" the metal to present such an appearance.

(5) J. B. C.—The lines on the "jellograph" may be removed by remelting the composition. We know of no better or simpler way.

(6) J. M. writes: In your last number you give a method of making waterproof cloth by dissolving rubber in bisulphide of carbon and adding a certain percentage of alcohol. Now, I cannot find any of our druggists that can make that preparation. They say if you had given a certain amount of rubber to bisulphide of carbon, then they could tell what percentage or how much six per cent of alcohol is. A. Bisulphide of carbon 94 oz.; absolute alcohol, 6 oz.; mix a sufficient quantity of this to accomplish the softening of the rubber.

(7) A. B. T. writes: I live in a locality where much of the water is strongly impregnated with lime. After using for two or three months the hot water pipes leading from the range to the boiler in my kitchen become entirely closed by the sediment deposited in them during the boiling of the water, and this obstruction afterwards hardening can only be removed by a cold chisel. What can be done to soften the water without injuring its quality for ordinary purposes, or to prevent its clogging the pipes and incrusting the boiler? A. Try the addition of a small quantity of dry slaked lime, beginning with about 10 grains of lime to the gallon. The "lime" in the water is doubtless lime carbonate, held in solution by free carbonic acid. The addition of a suitable quantity of lime under the circumstances withdraws the free carbonic acid, forming with it insoluble carbonate of lime; and at the same time throwing down what lime carbonate the acid water held. The only other practical remedy is to heat the water, when the acid gas escapes, leaving the lime carbonate insoluble. Water very often contains more or less sulphate of lime, which cannot be economically eliminated.

(8) J. Y. asks. 1. How is sheet metal prepared for tinning? A. The plates, bent V-shape, are placed on edge in a pickle of dilute muriatic (water 6, acid 5) acid for about five minutes, then placed in a row (Λ) on the floor, and by means of a rod passed through them lifted into an annealing oven, where they are heated to redness and the scale drops off. They are then allowed to cool, straightened on an anvil, and cold rolled between highly polished rolls under great pressure. The plates are then immersed in fermenting bran water, at 100° Fah., for 12 hours, the plates standing on one edge being reversed after six hours. From the bran water the plates are transferred to a pickle of dilute sulphuric acid at 100° Fah. for an hour, which makes them bright; then washed and scoured with hemp and sand, and after washing in clean water are ready for the grease pot, in which they are kept for an hour or more before putting in the tin bath. 2. What material are the vessels made of for holding the acids in the tinning process? A. Usually of wood.

(9) C. asks: 1. What is 1 horse power? A. 33,000 lb. raised one foot high per minute. 2. Man's power? A. The usual allowance is five to six men equal one horse. 3. In what book on mechanics can the principle of the pulley and the duplication of force by it be studied best? A. "Jamieson's Mechanics," "Cambridge Mechanics."

(10) L. G. S. asks: How many horse power make a "run of stone," that is, in a run of stone (so-called) what amount of force is given when computed in horse power? In this community, where water power is used exclusively, I have asked several, and find no two to agree in the estimate. Will you give it? A. The power required to drive a "run" of stones depends upon their weight and diameter and the velocity at which they are driven. Formerly from 5 to 8 horse power was allowed, but on account of increased weight and velocity we suppose that now from 7 to 12 horse power should be allowed.

(11) W. C. B. asks: 1. Can you inform me how to construct a compressed air tank to run a one horse power engine? A. The best form is a plain cylinder, like a cylinder boiler; its capacity will depend upon the length of time you wish to run the engine with one charge of air. 2. Can I buy such a thing, and if so, where? A. Such reservoirs may be obtained from almost any boiler maker.

(12) H. L. C. asks What should be the number of revolutions per minute of a 8 inch circular saw, and also of a planer head, 1½ inches diameter, to do good work on hard or soft wood? Will the planer work with 2,200 per minute? A. We should say 7,000 to 8,000 revolutions per minute. The head is very small, and may be run 4,000 to 4,800 revolutions per minute.

(13) S. H. B. asks: 1. Is the steel of any special grade required for permanent magnets, or must it be forged in any particular way to get compactness of grain? A. A medium quality of steel is better than the finest. It should be worked as little as possible, and should be hardened throughout and drawn down to a straw color. 2. Are they magnetized by a coil of wire or with a strong electro-magnet? I have an electro-magnet which will readily lift more than one hundred pounds, cores 1 inch diameter, four layers of wire about No. 14, six cells Grove battery, platinums 3 by 3 inches, but I do not get very strong magnets by this means yet. A. For charging bar magnets a coil which will just fit the bar seems to answer little better than an electro-magnet. You should make the coil of No. 14 wire; 8 or 9 layers should be wound one over the other. The coil should be about 3 inches long. Connect this coil with your battery, hold it vertically, and insert one of the steel bars; allow it to become suspended centrally in the coil, then push it down so that the upper end of the bar is within the coil. Allow the bar to come back to its central position, and then, before removing it from the coil, disconnect the latter from the battery. This method of magnetizing steel is described and illustrated in SUPPLEMENT 142. Telephones.—Horseshoe magnets may be charged by drawing them across the face of your large magnet always in the same direction, and disconnecting the battery as the stroke is completed. Bar magnets may be charged in the same way by clamping two of them together by the ends so as to form temporarily a horse shoe. 3. How would quite thin steel, say one-sixteenth, do, if pieces enough were used to make a magnet, say, 1 inch square section and of horse shoe shape, 8 inches long? A. Very well, but they would make a better magnet if bent one over the other. 4. Is not the Jamin magnet of even thinner steel than that? Those I mentioned are of one-quarter inch thick steel and nearly one inch broad. A. Yes. 5. Would it be as well to pack up a compound magnet of straight squared pieces, and magnetize them separately, as to make the separate horseshoe shapes? A. No, the horse-shoe shape would be the best.

(14) A. C. asks: 1. What is the variation of pressure in the steam chest of a locomotive engine when she is running at regular speed with throttle open full and lever set to cut-off at half stroke, steam pressure on boiler 100 lb.? A. The variation in pressure will be from full boiler pressure, when steam is cut off, to a minimum pressure, depending upon proportions, pressure, and speed of piston. 2. How much will water compress under a pressure of 100 lb. to square inch? How much will oil compress under the same pressure? A. Compression scarcely appreciable with either water or oil. 3. How much will air compress under 100 lb. pressure? A. 100 lb. pressure above the atmosphere is =7·7 atmospheres—hence bulk=1-7·7 or a little more than ⅛.

(15) W. T. S. asks: 1. About how many horse power do we get with our engine, 7x10 inches, running at about 400 revolutions per minute, with 1¼ inch feed pipe, pressure 80 lb. per square inch? A. With 80 lb. pressure on the piston and 400 revolutions per minute, 46 horse power. 2. If the throttle valve of an engine be set to run it at 100 revolutions per minute, with 20 lb. of steam, would it not require about 80 lb. of steam to run it 200 revolutions per minute, the valve being the same as for 20 lb.? A. If 20 lb. is sufficient to overcome the resistance at 100 revolutions, it will be approximately the same (leaving out friction) at 200 revolutions, but you must supply double the quantity of steam at that pressure.

(16) E. A. G. writes: It is said that even "Homer sometimes nods," but the SCIENTIFIC does not often so much as wink. But please tell me, is it not as wise to bore a hole in the bottom of a boat to let the water out as to put a stop cock at the highest part of a siphon "to let the air out?" See SCIENTIFIC AMERICAN, April 10, page 230, answer to C. W. W., No. 35. Some one may be misled by it. A. Your criticism applied to an ordinary siphon is very pertinent, but we do not think it applies to the conditions in this case. The stop cock should be applied in connection with some means of taking out the air accumulating from leaks. Of course it was an error to say briefly stop cock. A pump or some other device for removing the air must be applied outside the stop cock.

(17) "Walter" asks: Which travels the greater distance, any given point on the face or tread of a locomotive driving wheel, or any fixed part of the locomotive, the boiler for instance? The wheel is not supposed to slip on the rail during the journey. A. The lower point of the wheel in contact with the rail has no forward motion relative to the rail; the upper point has twice the forward motion of the boiler.

(18) "Constant Reader" asks: Does a fly wheel increase the power of the engine to which it is applied? A. No.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

T. C. W.—It consists chiefly of a semi decomposed syenitic rock with a little hematite. It cannot be called an iron ore; such an ore may occur in the vicinity.—M. D. M.—It is a fair quality of kaolin, used for making porcelain, "white ware," and pottery.—G. C. R.—It is limonite, an excellent ore of iron.—J. H. B.—The button is composed chiefly of lead, carrying a trace of silver. It probably occurs as galena—sulphide of lead.

COMMUNICATIONS RECEIVED.

On a Remarkable Group of Sun Spots. By W. R. B.
On a Freak of Lightning. By F. M. G.
On Tide Water Pipe Line. By G. L. R.
On the Cause of Thunder. By G. H. E.
On Examples of Pseudo-Crystallization. By A. L.
On Gravitation. By W. L. T.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

pril 20, 1880.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Addressing machine, E. F. Pernot	226,391
Anvils, J. Kleinhans	226,416
Ash bod, N. H. Andrews	226,599
Axle box, car, B. H. Shoemaker	226,797
Bag holder, W. B. Allen	226,380
Baking powder can, J. S. Taylor	226,804
Ballot box, J. H. Drake	226,736
Ballot box, J. Welch	226,609
Banjo, J. H. McQuilkin	226,421
Beans, peas, etc., for food, preparing, W. Butts	226,712
Bee hive, R. Hines	226,612
Belt, galvanic, T. W. Graydon	226,629
Bit brace, C. H. Amsden	226,646
Blast furnace, P. L. Weimer	226,681
Boiler tubes, fastening, C. Graham	226,641
Boot and shoe counter or heel stiffener, V. B. Morton	226,771
Boot and shoe heel, T. Cook	226,631
Breakwater, L. Kirkup	226,683
Bridge gate, draw, A. S. Sherman	226,796
Buckle, J. Rothenbucher	226,600
Button, C. H. Wood	226,815
Button and button fastener, S. L. D'Aubigne	226,722
Button, cuff, H. A. Fisher	226,786
Button, sleeve, L. Morse	226,769
Buttons, etc., machine for the manufacture of, J. F. Empletmann	226,686
Cabinetmaker's clamp, J. L. Konig	226,621
Calculator for postage stamps, G. W. Terry	226,667
Car coupling, O. H. Drinkwater	226,627
Car coupling, J. D. Gray	226,762
Car door fastening grain, O. H. Drinkwater	226,728
Car mover, lever power, Van Anker & Gum	226,806
Car spring, B. Cliff	226,587
Carbureter, gas, H. J. Ferguson	226,820
Carpet stretcher and tack driver, G. Terrill	226,634
Carriage, child's, C. Mattern	226,707
Cart, dumping, Z. Butt	226,849
Cart, self-loading, A. Vreeland	226,686
Check rower, Berry & Putman	226,700
Churn power, G. A. Brongis	226,764
Cider press, H. S. Tumpkins	226,677
Clasp or link, P. W. Doherty	226,725
Clinometer, F. C. Davidson	226,720
Collar frames, die for forging metallic bows, Fisher & Watson	226,737
Compass adjusting binnacle, J. R. Hand	226,669
Convertible chair, C. A. Eastman	226,730
Corn sheller, J. W. Hicker	226,627
Corset, J. C. Tallman	226,820, 226,836
Cotton scraper and chopper, comb'd, L. D. Bowman	226,792
Cradle, grain, E. H. Scott	226,690
Cultivator, R. J. West	226,691
Cultivator and harrow combined, J. W. Fleming	226,626
Cultivator, rotary, M. Johnson (r)	9,148, 9,149
Damper, stove pipe, Selden & Griswold	226,660
Dishes, butter holder for butter, W. B. Mackay	226,666
Door check, H. R. Preden	226,766
Door lock handle, sliding, W. H. Sparks	226,662
Drawings and photographs, method of and apparatus for tinting, W. Kurtz	226,760
Dredging machine, vacuum, Hedge & Cushman	226,661
Dust receiver, carpet and floor, N. Fyles	226,798
Duster, feather, A. R. Davis	226,631
Elevator, C. R. & N. P. Otis	226,673
Fare register and recorder, N. A. Ransom	226,628
Feed rack, portable grain and hay, J. A. Kennedy	226,787
Feed water heater and filter, J. W. White	226,814
Fence post, S. Reed	226,700
Fiber, process and apparatus for manufacturing, Stephens & Durkin	226,801
Fifth wheel, H. Timkin	226,698
Firearm, breech-loading, C. Guyer	226,744
Firearm, breech-loading, A. Schneider	226,679
Firearm, breech-loading, C. E. Snaider (r)	9,156
Firearm, magazine, F. W. Tiesing	226,825
Fire escape ladder, M. Sichel	226,798
Fluid meter, C. A. Chandler	226,716
Fluting iron, W. S. Owen	226,776
Fluting iron, F. R. Stumpf	226,808
Folding chair, J. L. Styron	226,696
Fruit jar, S. M. Erdman	226,636
Fruit jar top, J. A. Paul	226,779
Furnaces, device for feeding air to, H. T. Drain et al.	226,630
Game board, J. K. Ingalls	226,618
Gas, manufacture of nitrogen, T. R. Stillman	226,687
Gate, G. H. Alyworth	226,606
Glass and enamel to metal, uniting, L. Morse	226,770
Glass house furnace, J. J. Gill	226,630
Grain binder, H. E. Pridmore	226,785
Grain, etc., drier and cooler for, May & Stark	226,669
Grain frame, J. Walsh	226,640
Grinding mill, W. H. Pardoe	226,777
Handle for trunks, bags, etc., M. Schwerin	226,794
Harness back band loop, R. M. Selleck	226,681
Harness clamp, E. Peters	226,702
Harness loops, machine for pressing and ornamenting, Lane & Avery	226,791
Harrow, Pendley & Moss	226,685
Harvester, grain, F. W. Randall	226,672
Harvester reel, W. H. Akens	226,580
Hatch, skylight, S. J. Pardessus	226,685
Hay knife, D. E. Haskell	226,746
Hay tedder, J. M. Burdick	226,711
Heating apparatus, steam, J. L. Horley	226,765
Heel plate, J. A. Cole	226,720
Heel stiffener and counter support, A. S. Robinson	226,798
Hinge, lock, W. S. Stockman	226,694
Holdback, vehicle, A. B. Douglas	226,656
Hook and eye fastener, B. Schleifer	226,786
Horse foot cooler and moistener, C. A. Hoot	226,689
Horse power, J. Piggott	226,784
Horse power attachment, R. D. Norton	226,671
Horse toe weight and quarter boot attachment, H. D. McKinney (r)	9,163
Horses, vehicle device for hitching, O. Dunkel	226,659
Hub, vehicle wheel, A. A. Philbrick	226,778
Hydraulic engine, J. B. Cole	226,590
Infusions, apparatus for making, D. P. Heap	226,611
Jelly strainer, J. C. Mueller	226,773
Jewelry and fancy articles, plastic composition of matter for making, I. D. Abrahams	226,595
Key ring, J. S. Birch	226,597
Knit fabric, R. F. M. Chase	226,585, 226,586
Lamp, hanging, O. F. Richberg	226,733
Lamp, hanging or suspension, E. L. Bryant	226,708
Locomotive ash pan, C. O. Smith	226,780, 226,800
Locomotive boiler, B. H. Angamar	226,604
Loom for weaving tubular fabrics, H. W. Cady	226,594
Loom stop motion, F. O. Tucker	226,810
Low water alarm for steam boilers, W. R. Jenkins, Jr.	226,754
Lubricator, J. E. Lonergan (r)	9,154
Marker, field, W. Barron	226,597
Mechanical movement, R. C. Barrie, Jr.	226,580
Mechanical movement, J. Hill	226,751
Metal stamping, punching, and shearing machine, M. Harsberg	226,673
Microscope slides, turn table for, W. H. Bulloch	226,643
Middlings separating machine, A. & A. N. Wolf (r)	9,158
Millstone dresser, D. S. Greenwald	226,630
Moulding machine, C. Heard	226,685
Mowing machine, J. F. Stewart	226,683
Musical instrument, mechanical, J. A. Carter	226,714
Oil, apparatus for testing lubricating, C. N. Waite	226,689
Oiler, car axle, W. H. & F. J. Burden	226,710
Ore desulphurizing apparatus, R. P. Wilson	226,692
Packing for piston rods, metallic, J. A. Osgood	226,694
Packing, metallic steam, W. P. & C. R. Woodruff	226,644
Padlock, permutation, Cook & Green	226,589
Pamphlet box, T. L. Clacher	226,727
Paper and process of making the same, H. Hayward	226,682
Paper pails, machine for making, E. Hubbard	226,752
Pen, D. MacKinnon	226,616
Pen holder, fountain, J. Monaghan	226,766
Pencil and crayon holder, B. A. Fiske	226,607
Pianoforte music desk, H. Praeger	226,674
Picture frame, W. L. Eckman	226,604
Picture frame attachment, J. W. Larcher	226,762
Pile, L. Kirkup	226,684
Pipe cleaner, J. H. Gable	226,740
Pipe stem, C. J. B. Hirsch	226,750
Plant duster, J. F. Eddy	226,720, 226,721
Planter, cotton and corn, G. E. Faucher	226,754
Planter, hand corn, T. Pickerton	226,701
Plate and dish, A. A. Love	226,605
Pliers, R. B. Jones	226,784
Plow, M. Glasscock	226,606
Plow, Wansbrough & Speer	226,663
Plow and cultivator wheel, Pendley & Moss	226,684
Plow attachment, A. F. Fromm	226,651
Plow attachment, E. R. McCall	226,667
Plow, sulky, L. Brown	226,705
Plow, sulky, F. M. Foster	226,739
Plumber block, B. Hewitt	226,747
Pocket safety, J. Rosenstock	226,679
Poison distributer, Amor & Lane	226,580
Post office delivery window, G. J. Kreis	226,730
Pressure gauge for beer stills, D. Horan	226,614
Printed and varnished sheets, machine for drying, L. A. Fernow	226,735
Printing presses, collating attachment for, C. Ellery	226,604
Pulp strainer, L. Zeyen	226,810
Pump, rotary, E. B. Newcomb	226,772
Pump, windmill, J. & R. Beau	226,600
Railway rail, A. C. Vaughan	226,811
Railway switch and signal apparatus, pneumatic, H. Turner	226,627
Ruching machine, C. Clark	226,700
Sad iron, F. R. Sutton	226,683
Sand band, G. E. Purple	226,797
Saw, drag, J. Augspurger	226,590
Saw, drag, J. A. Claxton	226,719
Saw, endless chain, E. Nunan	226,717
Sewing machine, J. R. Richard	226,791
Scarf, neck, W. A. Laverty	226,703, 226,704
Scraper, wheeled, L. A. Sweatt	226,686
Seed crusher, cotton, W. L. Owen	226,775
Seed drills, drill point for, J. A. Jones (r)	9,160
Seed, machine for cleaning blue grass, J. D. Batson	226,590
Semolina, etc., apparatus for purifying and assorting, Thompson & Williamson	226,809
Sewer catch basin, P. Markey	226,620
Sewing machines, stand for power driven, L. Sternberger	226,802
Shawl strap handle and boot jack, M. B. Marsden	226,768
Sheep rack, S. A. Coe	226,650
Shoemaker's edge plane, A. P. Hazard (r)	9,167
Show case, G. C. Albaugh	226,646
Sign, L. Dobbelaar	226,724
Slate dressing machine, F. Shenton	226,776
Soldering iron, C. M. Dravo	226,602
Soldering iron heater, J. S. Hull	226,765
Spinning spindles, bearing for, J. E. Haworth	226,769
Spring motor, J. Warren	226,818
Square, dressmaker's, J. A. Emery	226,605
Stamp, branding, H. H. Bryant	226,777
Stanchion fastener, S. Bryant	226,700
Steam engine, R. C. Barrie, Jr.	226,581
Steam engine, Cope & Maxwell	226,600
Stocking supporter, C. C. Shelby	226,621
Stove lid bowls, etc., moulding, J. O'Keefe	226,672
Straw board, machine for lining, G. S. Eyster	226,733
Suspender clasp, M. Altmann	226,690
Tack strip, Woodward & Brock	226,817, 226,818
Tally, grain, W. Thornton	226,665
Tap wrench, T. R. Way	226,543
Tea kettle, N. A. Menaar	226,603
Teeth, composition for filling, T. Fletcher	226,730
Telephone signal, visible, C. Ader	226,584
Thill coupling, P. P. Johnson	226,756
Ticket holder, H. Conried	226,701
Tile machine, J. C. McKenzie (r)	9,162
Tobacco leaves, machine for booking, J. B. Pawling	226,779
Tracing wheel, D. W. Moody	226,623
Type distributing machine, J. North	226,630
Valve, steam engine slide, O. J. Byrud	226,710
Valve, steam engine slide, R. H. Carter	226,716
Vapor burner, J. S. Wood	226,816
Vault or tomb, burial, W. F. Groves	226,740
Vehicle running gear, P. Herdtink	226,748
Vehicle spring, W. B. Bennett	226,588
Vehicle wheel sand guard, C. W. Ammerman	226,587
Vise and drill, combined, C. Brunner	226,739
Wagon seat, G. W. Manlove, Jr.	226,765
Washing machine, J. Paterson	226,780
Watering stock, valve for water pipes for, W. A. Warren	226,812
Waxed ends, mechanism for the manufacture of, B. McIntosh	226,619
Whiffletree, E. Warren	226,642
Whitewash composition, A. H. Kerr	226,758
Wringing machine, F. Bernhardt	226,587
Yoke center, neck, J. S. Nelson	226,620
Yoke ring, neck, H. Jacobs	226,609

DESIGNS.

Cruets, pepper, S. McKee	11,744
Knit drawers, S. Conde	11,741
Knit shirts, S. Conde	11,740
Knitted fabrics, S. Appleton	11,736
Organ case, A. Wagner	11,742, 11,743
Scarf, neck, C. H. Crumette	11,739
Spoon and fork handles, W. Rogers	11,745

TRADE MARKS.

Medicinal preparation, C. M. Coolidge	7,899
Soda fountains, A. D. Puffer & Sons	7,901
Tickings, J. Farnum & Co.	7,879, 7,880

English Patents Issued to Americans.

From April 16 to April 23, 1880, inclusive.

Baking powder can, J. S. Taylor, San Francisco, Cal.
Coating iron, process for, J. B. Jones et al., B'klyn, N. Y.
Cloth stretching and calendering machine, C. A. Luther, Pawtucket, R. I.
Envelope machine, D. M. Lester, New London, Conn.
Electric light, H. S. Maxim, Brooklyn, N. Y.
Gas lighting apparatus, O. Isenminger et al., Bloomington, Ill.
Heating fluids, apparatus for, C. S. Cousins, Boston, Mass.
Hoisting and moving earth, apparatus for, H. A. Carson, Mass.
Holding letters, apparatus for, I. W. Heysinger, Philadelphia, Pa.
Life saving raft, M. Beasly, Philadelphia, Pa.
Meter, fluid, J. D. Gould et al., Boston, Mass.
Motive power engine, A. H. Hearington, Rochester, N. Y.
Motor chronometres, H. J. Wenzel et al., San Fran., Cal.
Pencil sharpener, M. C. Stone, Baltimore, Md.
Photography, G. C. Bell, Brooklyn, N. Y.
Railroad switch, J. H. Carey, Boston, Mass.
Railroad rail, A. C. Vaughn et al., Harrisburg, Pa.
Sewing machine motor, C. L. French, Brooklyn, N. Y.
Stoves and fireplaces, A. T. Bennett, Kenosha, Wis.
Stove, coal oil, J. H. Irwin, Philadelphia, Pa.
Steam pump, C. P. Deane, Springfield, Mass.
Telephone, E. Marx et al., New York city.
Tool handles, A. D. Tyler, Brockton, Mass.
Utilizing solar heat, apparatus for, E. J. Molera et al., San Francisco, Cal.
Water closets, W. Smith, San Francisco, Cal.

New Books and New Editions

RECENTLY PUBLISHED.

Overman—Fesquet.—The Moulder's and Founder's Pocket Guide. A Treatise on Moulding and Founding in Green Sand, Dry Sand, Loam, and Cement; the Moulding of Machine Frames, Mill Gear, Hollow Ware, Ornaments, Trinkets, Bells, and Statues; Description of Moulds for Iron, Bronze, Brass and other Metals; Plaster of Paris, Sulphur, Wax, etc.; the Construction of Melting Furnaces, the Melting and Founding of Metals; the Composition of Alloys and their Nature, etc., etc. By Fred. Overman, M.E. A new edition, to which is added a Supplement on Statuary and Ornamental Moulding, Ordnance, Malleable Iron Castings, etc. By A. A. Fesquet, Chemist and Engineer. Illustrated by 44 engravings. 12mo. $2 00

Stokes.—The Cabinet Maker and Upholsterer's Companion. Comprising the Art of Drawing as applicable to Cabinet Work; Veneering, Inlaying, and Buhl Work; the Art of Dyeing and Staining Wood, Ivory, Bone, Tortoise Shell, etc. Directions for Lacquering, Japanning, and Varnishing; to make French Polish, Glues, Cements, and Compositions; with numerous Receipts useful to workmen generally. By J. Stokes. Illustrated. A new edition, with an Appendix upon French Polishing, Staining, Imitating, Varnishing, etc., etc. 12mo. $1 25

Rose.—The Slide Valve Practically Explained. Embracing simple and complete Practical Demonstrations of the operation of each element in a Slide Valve Movement, and illustrating the effects of Variations in their Proportions by examples carefully selected from the most recent and successful practice. By Joshua Rose, M.E., author of "The Complete Practical Machinist," "The Pattern Maker's Assistant," etc., etc. Illustrated by 35 engravings. 12mo. $1 00

Rose.—The Complete Practical Machinist. Embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, etc., etc. By Joshua Rose. Illustrated by 130 engravings. 6th edition. 12mo. $2 50

Edwards.—A Catechism of the Marine Steam Engine, for the use of Engineers, Firemen, and Mechanics. A Practical Work for Practical Men. By Emory Edwards, Mechanical Engineer. Illustrated by 60 engravings, including examples of the most modern Engines. 3?4 pages. 12mo. $2 00

Davies.—A Treatise on Metalliferous Minerals and Mining. By D. C. Davies. Illustrated by numerous engravings. xx, 4?? pages. 12mo. $5 00

Ware.—The Sugar Beet. Including a History of the Beet Sugar Industry in Europe, Varieties of the Sugar Beet, Examination, Soils, Tillage, etc., etc. By Lewis S. Ware, C.E., M.E. Illustrated by 90 engrs. 8vo. $4 00

Elder.—A Memoir of Henry C. Carey. By Wm. Elder. With a Portrait. 8vo. cloth. $0 75

The above or any of our Practical and Scientific Books sent by mail, free of postage, to any part of the world, at the publication prices. Our catalogues, covering all practical subjects, sent free to any one who will furnish his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA, PA.

EMPIRE BRONZE POWDER MF'G CO.
48 John St. New York.

Perfectly Smooth, Thoroughly Seasoned

CUT THIN LUMBER!!

Manufactured by our Patent Board Cutting Machines and Seasoning Process.

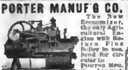
Pronounced the only Perfect Cut Lumber!!

MAHOGANY,

Rosewood, Satinwood, Walnut, Ash, Red Cedar, Cherry, Oak, Poplar, Maple, Holly, French Walnut, etc., etc., in Logs, Planks, Boards, and Veneers.
Send for catalogue and price lists.

GEO. W. READ & CO.,
186 to 200 Lewis St., foot 5th and 6th Sts., New York.

PORTER MANUF'G CO.



The New Economizer, the only Agricultural Engine with Return Flue Boiler in use. Send for circular to Porter Mfg. Co., Limited, Syracuse, N. Y.

G. G. YOUNG, Gen. Agt., 42 Cortland St., New York.

ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.

The George Place Machinery Agency

Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

THOMAS' OSTEOPHONE 1.50 PER SET

FOR THE DEAF.—Sold by principal Druggists and Stationers. Mailed on receipt of price, by manufacturers. Circulars free.
A. C. FARLEY & CO., Philadelphia, Pa.

SPARE THE CROTON AND SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N. Y., who control the patent for Green's American Driven Well.

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

Model Engines.

Complete sets of CASTINGS for making small Model Steam Engines 1 1-2 in. bore, 3 in. stroke, price $4; ditto 2 in. bore, 4 in. stroke, price $10, same style as cut. Gear Wheels and Parts of Models. All kinds of Small Tools and Materials. Catalogue Free. GOODNOW & WIGHTMAN, 176 Washington Street, Boston, Mass.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators.
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

IMPLEMENTS, MACHINERY, ETC.

Catalogues, prices and Agency terms solicited. Unexceptional references. OSKAR NETZLER, Agent in Brisbane, Queensland, Australia.

THE SKINNER PORTABLE & STATIONARY ENGINES & BOILERS & GOVERNORS
FIRST CLASS & ECONOMICAL. SKINNER & WOOD, ERIE, PA.
SEE ILLUSTRATED ADVERTISEMENT

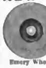
JOHN R. WHITLEY & CO.

European Representatives of American Houses with First-class Agents in the principal industrial and agricultural centres and cities in Europe. London, 7 Poultry, E.C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

NEW YORK BELTING AND PACKING COMP'Y.

The Oldest and Largest Manufacturers of the Original

SOLID VULCANITE EMERY WHEELS.



Emery Wheel.

All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.

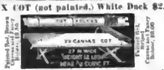
Address NEW YORK BELTING AND PACKING CO.,
JOHN H. CHEEVER, Treas. NEW YORK.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
235 BROADWAY, NEW YORK.

XX COT (not painted,) White Duck $2.



Makes a perfect bed. No mattress or pillows required. Better than a hammock, as it fits the body as pleasantly, and lies straight. Folded or opened instantly. Self fastening. It is just the thing for hotels, offices, cottages, camp-meetings, sportsmen, etc. Good for the lawn, piazza, or "coolest place in the house." Splendid for invalids or children. Sent on receipt of price, or C. O. D. For 50 cts. extra, with order, I will prepay expressage to any railroad station east of Mississippi River and north of Mason and Dixon's line. For 75 cents, in Minnesota, Missouri, and Iowa.

HERMON W. LADD, 108 Fulton St., Boston; 207 Canal St., New York; 165 North Second St., Philadelphia. Send for Circulars.

CLUTE BROTHERS & CO., Schenectady, N. Y., High Speed Yacht Wheels. Yacht and Tug Engines a specialty.

Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by

WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.

NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

ALAND'S
Silent Injector, Blower & Exhauster.
Apply to S. ALAND, Rome, Oneida Co., N. Y.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W 29 ST NEW YORK CITY

BUCKET PLUNGER STEAM PUMPS,

FOR EVERY DUTY.

VALLEY MACHINE CO.,
EASTHAMPTON, MASS.

AGENTS Catalogue free. $7 per day made easy. J. F. GAGE & CO., Boston, Mass.

KNOW THYSELF.

THE untold miseries that result from indiscretion in early life may be alleviated and cured. Those who doubt this assertion should purchase the new medical work published by the PEABODY MEDICAL INSTITUTE, Boston, entitled THE SCIENCE OF LIFE, or, SELF-PRESERVATION. Exhausted vitality, nervous and physical debility, or vitality impaired by the errors of youth, or too close application to business, may be restored and manhood regained.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jewelled medal by the National Medical Association. It contains beautiful and very expensive engravings. Three hundred pages, more than 50 valuable prescriptions for all forms of prevailing disease, the result of many years of extensive and successful practice, either one of which is worth ten times the price of the book. Bound in French cloth; price only $1, sent by mail, postpaid.

The London Lancet says: "No person should be without this valuable book. The author is a noble benefactor."

An illustrated sample sent to all on receipt of 6 cents for postage.

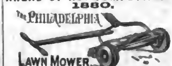
The author refers, by permission, to JOS. S. FISHER, president; W. I. P. INGRAHAM, vice-president; W. PAINE, M.D.; C. S. GAUNTT, M.D.; H. J. DOUCET, M.D.; R. H. KLINE, M.D.; J. R. HOLCOMB, M.D.; N. R. LYNCH, M.D., and M. R. O'CONNELL, M.D., faculty of the Philadelphia University of Medicine and Surgery; also the faculty of the American University of Philadelphia; also Hon. P. A. BISSELL, M.D., president of the National Medical Association.

Address Dr. W. H. PARKER, No. 4 Bulfinch Street, Boston, Mass. The author may be consulted on all diseases requiring skill and experience.

HEAL THYSELF.

AHEAD OF ALL COMPETITION!

1880.



EIGHT SIZES FOR HAND USE.
Weighing from 23 to 51 lbs.
THREE SIZES FOR HORSE POWER.

The very large increase in our sales last year prove that these machines fully sustain the awards "AS THE BEST" made to them at the great Centennial "hundred day trial," in Philadelphia, in 1876, and their complete victory at the Paris Exposition in 1878. We offer for 1880, Machines from entirely new patterns and greatly improved in every respect.

Examine our New Lawn Sweepers. Hand or Horse size.

GRAHAM, EMLEN & PASSMORE,
Patentees and Manufacturers,
631 Market St., Philadelphia, Pa.
Send for Descriptive Catalogue with prices.

TELEPHONE Works 1 mile. Price $3.50. Pat'd
Circulars free. HOLCOMB & CO., Mallet Creek, Ohio.

ALL KINDS OF
WOOD WORKING MACHINERY
IRON WORKING TOOLS
SPECIAL TOOLS, &c.
MANUFACTURED BY
H. B. SMITH MACHINE CO.
SMITHVILLE, BUR. CO., N. J.
CIRCULARS FREE

Forster's Rock & Ore Breaker and Combined Crusher and Pulverizer.

The simplest machine ever devised for the purpose.

Parties who have used it constantly for six years testify that it will do double the work of any other Crusher, with one-third the Power, and one-half the expense for keeping in repair. The smaller sizes can be run with Horse Power.

Address TOTTEN & CO., Pittsburgh, Pa.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.

DAVID W. POND, Worcester, Mass.

Grain Speculation

in large or small amounts. $25 or $25,000. Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., CHICAGO, ILL., for Circulars.

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought

STRUCTURAL IRON.

It is believed that, were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders on application.

IT PAYS to sell our Rubber Hand Printing Stamps. Circulars free. G. A. HARPER & BRO., Cleveland, O.

Paris, . . 1878
Australia, 1877
Phila., . . 1876
Santiago, 1875
Vienna, . 1873

J. A. FAY & CO'S

WOOD WORKING MACHINERY

was awarded at the Paris Exposition over all competitors THE GOLD MEDAL OF HONOR. Also highest award at Phila., Santiago, Australia, and Vienna. It is

Original in Design, Simple in Construction, Perfect in Workmanship, Saves labor, Economizes lumber, and Increases products of the highest standard of Excellence.

Railroad, Furniture, and Agricultural Implement Shops, Planing Mills, etc., equipped at short notice, and the lowest cash prices. Send for Circulars.

J. A. FAY & CO., Cincinnati, Ohio, U. S. A.

Leffel Water Wheels,

With recent improvements.

Prices Greatly Reduced.

8000 in successful operation.

FINE NEW PAMPHLET FOR 1879,
Sent free to those interested.

James Leffel & Co.,
Springfield, O.
110 Liberty St., N. Y. City.

The Premium Bucket.

DUC'S IMPROVED ELEVATOR BUCKET.

Made in sizes from 5½ to 20 inches. For use in FLOUR, GRAIN, MALT, ORES, COAL, BROKEN STONE, SAND, DUTCH, SPICES, PLASTER, etc., etc. These buckets are struck out from the best charcoal iron, and are almost indestructible. No corners to catch. No seams to burst. Run with great ease and fill full every time. No interior corners to clog up.

T. F. ROWLAND, Sole Manufacturer, Brooklyn, N. Y.

STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.
709 Market St., St. Louis, Mo.

THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.

WORTHINGTON STEAM PUMPS of all sizes and for all purposes.

Prices below those of any other steam pump in the market.

WATER METERS. OIL METERS.

COE BRASS MFG. CO.
WOLCOTTVILLE CONN.
BRASS AND COPPER IN SHEETS
MATERIALS FOR METALLIC AMMUNITION A SPECIALTY.
WIRE AND BLANKS

Steel Castings

From ¼ to 15,000 lb. weight, true to pattern, of unequaled strength, toughness, and durability. 15,000 Crank Shafts and 10,000 Gear Wheels of this steel now running prove its superiority over all other Steel Castings. Send for circular and price list.

CHESTER STEEL CASTINGS CO., 407 Library St., Phila., Pa.

ORGAN BEATTY PIANO

New Organs 13 Stops, 3 set Golden Tongue Reeds, 2 Knee Swells, Walnut Case, warnt'd 6 years, Stool & Book $98. New Pianos, $143 to $255. Newspaper sent Free. Address Daniel F. Beatty, Washington, New Jersey.

CAVEATS, COPYRIGHTS, LABEL REGISTRATION, Etc.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1866, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 20, 1866, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

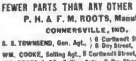
A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.

BRANCH OFFICE.—Corner of F and 7th Streets, Washington, D. C.

ROOTS' NEW IRON BLOWER.



POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED
IS SIMPLER, AND HAS
FEWER PARTS THAN ANY OTHER BLOWER.
P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 8 Dey Street,
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street, NEW YORK.

SEND FOR PRICED CATALOGUE.

PROSPECTUS
OF THE
Scientific American
FOR 1880.
The Most Popular Scientific Paper in the World.
VOLUME XLII.—NEW SERIES.
Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 22. [NEW SERIES.] NEW YORK, MAY 29, 1880. [$3.20 per Annum. POSTAGE PREPAID.]

STOVE MANUFACTURE—WORKS OF FULLER WARREN & CO. TROY, N. Y.—[See page 340.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, MAY 29, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 230,
For the Week ending May 29, 1880.
Price 10 cents. For sale by all newsdealers.

PATENTS FOR NOT INVENTING.

The constitutional authority for the patent laws of the United States rests on Section 8 of Article 1 of the Constitution, which provides that Congress shall have power "to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

The section of the revised statutes which describes what inventions may be patented carefully limits them to such as are new and useful, and the patentee must in all cases be the inventor or his heirs at law. This has been the policy and practice of the Patent Office from the beginning; and it would seem to be the only one authorized by the Constitution.

The House Committee on Patents, however, appear to think differently, as they have just reported back favorably Mr. Casey Young's bill (H. R. No. 3,041) offering patents to such as are not inventors, for the introduction of inventions which are not new. The bill reads as follows:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That any person or persons who introduce from a foreign country any secret art, invention, or process useful and important to the public, and not patented there, and at the time of application not understood in this country, may, upon payment of the fees required by law, and other due proceedings had as in the case of new inventions, obtain a patent therefor. And it is hereby declared that any secret art, invention, or process which has been used or practiced, unpatented, for the period of fifty years last past exclusively in the country where obtained, shall be deemed a secret in the meaning of this act."

As was pointed out in the SCIENTIFIC AMERICAN, January 31 last, this is a radical departure from the policy and purpose of all our patent legislation hitherto.

The propriety of granting such great privileges is as doubtful as is the authority of Congress to do it. And it would certainly be a strange way to encourage progress in the useful arts to place inventors of what is new on a level with the mere importer of what is at least fifty years old. Who it is that desires the enactment of such a law, or for what reason, does not appear.

THE PAGE PATENTS.

Undoubtedly some of the ablest decisions ever given in our courts have been those involving the validity of patents and questions of infringement. In such cases, the trials being in equity, and the proceedings never hastened, the lawyers generally have the most ample opportunity for thorough preparation, and the nicety with which they make hair-splitting distinctions often gives their arguments a most subtle flavor, provided their reasoning be equally close, and the reader or listener be not interested therein in the matter of dollars and cents. Speciousness and sophistry are nowhere else more cunningly introduced, and the courts need to exercise the utmost discrimination to hold the scales with so even a balance that exact justice will be done.

Among the closely reasoned decisions in patent cases which the records of our courts have shown in late years, several which have been rendered by Judge Samuel Blatchford, of the United States Circuit Court for the Southern District of New York, are particularly conspicuous for their keen analysis of the points in controversy, their close application of the law and the evidence, and the subtle reasoning by which conclusions have been reached that were oftentimes disappointing to all the parties concerned. The decision recently made by him relative to a petition for a rehearing in the Page patent case is a paper of this character. We have heretofore presented a pretty thorough exposition of the points originally at issue in the suit of the Western Union Telegraph Company against the Holmes Burglar Alarm Company, as well as the grounds on which were based the petition of the American Union Telegraph Company, and several railroad corporations, for a rehearing, after the decision in the original suit had been rendered, but before the filing of the interlocutory decree. The case in favor of the petitioners was presented by an imposing array of able counsel, but their prayer was denied by the court, in a decision filed on the 7th of May.

In the original decree the validity of the Page patent was sustained as respects its 11th, 12th, and 13th claims, for the retractile spring, armature, and set spring, found in electro-telegraphic machines, and the defendant was declared to infringe by "making and selling telegraphic burglar alarms in which a circuit breaker acts automatically to break the circuit, so that by the movement of an armature to and from an electro magnet a bell is rapidly struck by a hammer, and which alarms contain the inventions covered by said three claims." Without going over all the points made by the petitioners, it will be sufficient to say that, although the defendant did not use the inventions named on long or main circuits, and their application by the defendant was somewhat different from the way in which they are used in general telegraphing, yet the petitioners feared a decree would be issued which would enable the plaintiff, the Western Union Telegraph Company, to enjoin them from the use of somewhat similar devices in a quite different way, and for other purposes. It is no unusual result of a long-contested patent suit to find a successful plaintiff applying for injunctions against a much wider field of alleged infringers than he had first contemplated as coming within the scope of his patent, and making it appear that the decision in his favor is far more general in its application than a strict legal construction of the language employed by the court would warrant. Looking at the matter in this light, the presentation of the petition, the offers to show proof on points not fully presented in the original trial, and the able arguments made, will undoubtedly serve a useful purpose, even though the prayer of the petitioners has been denied, for the manner in which the court suggests the limitations of the previous decree, defines the points upon which it was made, and refers to the record, will make it difficult for the plaintiffs to give it any wider application than in the matter of these burglar alarms, which the defendant has, except to a small extent, ceased to make in the way specified.

The court, it is true, refuses to indicate what would be its decision in case suit was brought relative to infringement in an apparatus used for telegraphing on long or main circuits, but, while pointing out that the petition is before the court from corporations not parties to the suit, who would have ample and proper opportunity to defend themselves when directly sued, when their new and additional evidence might be legitimately introduced, makes the following significant declaration: "It is quite sufficient to say that whenever the defendant shall use what is suggested in connection with a long or main circuit for telegraphing, and shall be proceeded against for doing so, an issue will be raised which it will be proper then to consider, but that *no such issue has arisen.*" The court takes no cognizance of the proposed new evidence, and points out that it is in no way substantiated by oath whether there is any new evidence or not, or "what knowledge or information is had or not had," that was not before in possession of the court; the offer is only as to a solicitor's "best knowledge and belief," and "the best knowledge, information, and belief of the solicitor may be none at all." The matters of fact and of law sought to be raised by the petitioners are declared to be not in issue in the suit, and it would be a wrong to the plaintiff to consider them in any way to give such construction to the patent as does not legitimately arise from the record, and it is held that a new suit, where the petitioners are parties in interest, will afford the only opportunity to bring in these further issues.

HONORS TO AN INVENTOR.

The authorities of the city of Blois, France, have determined to erect a monument to Denis Papin, an ingenious inventor of the seventeenth century, for whom it is claimed the honor of having made the first useful application of steam power. Whether this claim can be substantiated or not is doubtful, for, besides uncertainty as to the stories about Papin's inventions, there are prior inventors with more or less vague claims of the same kind. The difficulty of determining who is first with inventions of our own day and generation is increased immeasurably when a question of priority is raised as to devices two hundred and more years old. However, whether Denis Papin made the first steamboat or not, he was certainly an ingenious and useful inventor, who, with others, paved the way for the many useful applications of steam to industrial work since devised, and it is conceded on all sides that he at least invented the lever safety valve. His story is that, being a victim of religious persecution, he left his native country, and, while living in Germany, about 1707, invented and constructed a steamboat, on which he and his family embarked, with the intention of exhibiting it on the Weser and then taking it to England. His invention was destroyed by the Mariners' Guild of the Weser, who had the monopoly of navigating that river; but his native town of Blois has now determined to erect a monument commemorating his inventive genius, and Mayor Chavigny writes to one of our daily newspapers asking the co-operation of America in honoring him. The *Public Ledger* properly adds: No injustice need be done Newcomen, Savery, Watt, Fitch, Oliver Evans, Fulton, Stevens, or others who, within the next hundred years, reinvented and improved engines and steamboats until really practicable and useful types of each were produced. Great inventions are almost always growths, the earlier stages of which can scarcely be recognized, but every one who helps them along is deserving of a fair share of the honor too often paid only to the man who gives them the finishing touch. Without going into questions of priority, Blois has abundant reasons to honor the memory of the almost forgotten Denis Papin.

THE ELECTRIC RAILWAY AN AMERICAN INVENTION.

On page 137, present volume of this paper, appeared illustrations and descriptions of Siemens' electrical railway motor, which was operated at the Berlin Exhibition in 1879. Since that publication our attention has been directed to a similar plan described in the SCIENTIFIC AMERICAN as long ago as September 25, 1847, which reads as follows:

Mr. Lilly and Dr. Colton, of Pittsburg, Pa., have invented a new method of railway propulsion, which is both novel and ingenious. The machine is a small locomotive, and is placed upon a circular railway, around which it is driven by electricity. The power is applied not to the locomotive, but to the *track*, in a very curious manner. Two currents of electricity, negative and positive, are applied to the rails, and by them communicate to the engine. The latter is provided with two magnets, which, by a process of alternate attraction and repulsion, drive the car over the track. A piece of lead is placed on the locomotive, making in all a weight of ten pounds, and on the application of the battery, the machine moved with astonishing rapidity up a plane inclined about five degrees. Heretofore the propelling power had been used on the car itself—in this instance, however, the power is placed on the rails, and an engineer

might remain in one town, and with his battery send a locomotive and train to any distance required.

It would seem from the above that the idea of railway car propulsion by electricity was projected in this country more than thirty years before Mr. Siemens' motor was introduced to the public.

PROF. TICE'S THEORY OF CYCLONES.

In reporting the results of his observations along the track of the tornado which proved so fatally destructive at Marshfield, Missouri, Prof. Tice, of St. Louis, expresses the opinion that all such whirlwinds, so called, are electrical storms, not wind storms. There was, he says, no wind attending the Marshfield tornado. Among the evidence of the electrical nature of that storm he notes the fact that it destroyed every building which had a tin roof or which had any metal of any kind in its roof. In Marshfield, it passed directly over several buildings with shingle roofs, and tore to fragments others, not more exposed, which had metal roofs. A mill, situated over a quarter of a mile away from the center of the cyclone, had its iron chimney torn out and carried a long distance, while the mill itself suffered very little damage. The cupola of the public school building at Marshfield, which had a tin roof, was wrecked, but the building, which was roofed with shingles, was not injured to any extent.

Even more conclusive and remarkable, he thinks, were the phenomena manifested in connection with trees and shrubbery. The bark was stripped from the trees and bushes not alone on those sides exposed to the force of the cyclone, but on all sides. The ends of the branches were not only denuded of their leaves and bark, but were rifted into fine fibers, so that they presented the appearance of little brooms. The active agent in such cases, he insists, was not wind, but electricity. Under its influence the sap under the bark was instantly converted into vapor or gas, expanding two thousand times in volume, and, as by an explosion, threw off the bark, shattered the trunk, and split the green twigs into fibers. That this is what took place is, he says, conclusively proved "by the fact that the dead and dry limbs and twigs were not affected, and though in immediate contact with green ones, remained intact."

General evidence of the electrical character of all tornadoes is found by Prof. Tice in the circumstance that, as a rule, they follow railroads and water courses, and either begin or expend their greatest energy upon them.

This, however, may be only a matter of topography. Rivers and railways usually follow the easiest grades, and these would naturally be followed by wind rushes taking the same general direction. It is a noticeable fact, all the same, that the cyclone which destroyed Marshfield followed the St. Louis and San Francisco Railroad for a distance of 145 miles, and lapped up all the water in the ponds and rivers in its course from where it commenced in Arkansas to where it terminated in Missouri.

NEW ATLANTIC SEAPORT IN FRANCE.

BY GEORGE L. CATLIN, LATE U. S. COMMERCIAL AGENT, LA ROCHELLE.

Prominent among the great public works projected by the French government, with a view to the commercial regeneration of France, is the construction of a new seaport at La Rochelle, at an estimated cost of 15,000,000 francs.

Owing to the building of a dike across the present harbor of that city by Cardinal Richelieu, during the famous siege of 1628, the accumulation of two centuries and a half's deposits of mud and sediment have so choked up the port that, with the exception of a channel twenty or thirty feet wide, it is bare at low water, necessitating a system of locks and basins constructed and maintained at great expense.

La Rochelle has from her earliest days (she dates from the 12th century) been renowned as an enterprising maritime city, and for two centuries previous to the war of secession her commerce with the United States, especially in wines and brandies, was active and important. Even with the above mentioned and continually increasing disadvantages to contend with, she has continued to maintain extensive commercial relations with the principal ports of Western and Northern Europe. Two lines of steamers keep up regular and frequent communication with Bilbao and the Spanish iron mines in the Cantabrian Pyrenees; there are lines of steamers to Bordeaux, to Cardiff, to Newcastle, and large annual importations are also made from North Germany, Norway, and Newfoundland. With this spirit of commercial enterprise still struggling for recognition, it was not to be supposed that the Rochellais would remain inactive in face of the renewed impulse which the present spirit of French institutions imparts.

After long consultation and careful scientific inquiry, it has been determined that but one sure method exists for obviating the present evil and restoring La Rochelle to her former maritime prestige, namely, the creation of a new port of entry within easy distance of the city, yet entirely independent of the harbor which Richelieu so effectually blocked.

Fortunately, nature, seeming to have foreseen and provided for this need, offers remarkable facilities for the construction of such a port about three-quarters of a mile north of the entrance to the present harbor, and at a point where communication with the city and the railroad system converging to it is easy and simple. At the point in question, known as the *Mare* (pond) *à La Besse*, there exists a natural inlet or depression which, by comparatively little labor, may be dug to the requisite depth and walled in by quays. This inlet opens upon a deep roadstead, known as the Pallice, completely sheltered from the sea by the islands of Ré and Oleron, between which vessels must pass to enter it. When, on the one hand, one considers the facilities which this point, above all others on the French coast, offers for direct communication in a straight unbroken course with New York and the other American seaports, without any of the dangers incident to channel navigation; and, on the other hand, the fact that from La Rochelle direct lines of railway radiate to Paris, to the interior and east of France, to Bordeaux, and to all points along the coast, both north and south, it will be seen at a glance that this grand undertaking promises to prove prolific in results to the commercial world. The work will be begun in June, 1880.

LEGISLATING ON COLOR BLINDNESS.

The Legislature of the State of Connecticut has passed an act authorizing the State Board of Health to prepare rules and regulations for the examination and re-examination of railroad employes in respect to color blindness and visual power, and prescribes the method in which and the intervals at which such examinations shall be made. The act further makes provision for inflicting penalties on any railway company employing persons who are not in possession of a certificate from the examining board of their freedom from color blindness. The examiners may revoke the certificate at any time. The State Board is, in the month of May, to recommend two or more medical experts to make the necessary examinations, and the Governor is to appoint two of these gentlemen on the following first of July. It is to be hoped that other States will adopt similar measures for protecting the traveling public against the dangers incident to the visual defect of railroad employes.

NEW YORK ACADEMY OF SCIENCES.

[*Continued from page 321.*]

The paper on the theory of cloud bursts, by Mr. William Ferrel, of the United States Coast Survey, has an especial interest at this season of excessive meteorological disturbance in the West. Cloud bursts, Mr. Ferrel said, always occur in the interior of a tornado. The primary cause of a tornado is difference of density arising from difference of temperature between the internal central part and the surrounding parts of the atmosphere. This only occurs on an unstable state of the air, in which the temperature of the surrounding air decreases more rapidly with altitude than the interior ascending column. Since the interior ascending column diminishes with altitude less rapidly than the surrounding quiescent air, this interior part is much warmer, and, consequently, ascends very rapidly, and the air from surrounding parts flows in below to supply the ascending current, as in the case of a chimney when the interior once becomes warmer than the surrounding air without. In addition to this difference of temperature and density, the air must have an initial gyratory motion, almost imperceptible. It may be, at a short distance from the center, but as it is drawn in it runs into rapid gyrations near the center, just as in the case of water running through a small hole in the bottom of a basin of water. If the gyrations above and below had the same velocity, the violence of the gyrations and the pressure toward the center below would depend upon differences of temperature only between the interior and exterior parts. But on account of the great friction near the earth's surface, the gyrations are much retarded there, and, consequently, the centrifugal force which prevents the rush of the air, in some measure, toward the center. If the difference of barometric pressure between the central and external parts were 30 millimeters, and no centrifugal force below or friction to resist this pressure, according to the laws of spouting fluids the ascending current in the interior would be about 80 meters per second. If the gyrating velocity below were only one half as much as above, the centrifugal force would be only one-quarter as much, and supposing that this and friction were to resist one-half of the pressure below toward the center, we should still have residual pressure which would cause an ascending velocity of about 56 meters per second.

This theoretical velocity is obtained upon no extravagant assumptions, and that such velocities do exist in tornadoes is confirmed by observations of their mechanical effects. It will only be necessary to refer to one well authenticated case of this sort, given in the Signal Service report, at Mount Carmel, Ill., 1877. The ascending currents of a tornado carried a church steeple, gilded ball, and vane, 15 miles. This must have been kept suspended in the air by the ascending currents 20 or 30 minutes. If saturated air at a temperature of 80° at surface ascends with a velocity of 50 meters per second, rain to the amount of 1·2 millimeters per second falls from the first 2,000 meters of altitude—equivalent to 0·3 inch per minute, or 18 inches per hour. At such a rate, if the tornado could be kept over the same spot for a short time from any cause, it would be called a cloud burst.

At higher altitudes than 2,000 meters it may be supposed that the vapor and rain is scattered out from the center and falls over a larger area. But rain may not only fall from clouds at this enormous rate, but an immense amount may be kept suspended in the air. Drops of 0·1 inch may be kept suspended in the air by a current of about 23 feet per second. Of course, the amount of rain kept so suspended increases the pressure in the center, and so much diminishes the force and energy of the tornado. Our assumed velocity of 50 meters per second arises from a difference of pressure of less than 15 millimeters. Suppose, now, rain enough was contained in the cloud to reduce this difference to 5 millimeters. This would require rain to the depth of 136 millimeters, more than 5 inches. The difference of pressure of 5 millimeters yet remaining would give an ascending current of about 32 meters per second, which is four times more than is necessary to keep the rain suspended in the air. If, now, for any reason, the whole system should be suddenly broken up, as, for instance, when the tornado strikes against a mountain side, and the ascending current by which the 5 inches of rain is kept suspended is suddenly cut off, of course, the whole amount would drop to the earth in a short time.

Lieutenant-Commander A. A. Michelson described some novel and interesting observations on sunlight seen through a narrow slit. As the width of the slit is diminished the diffraction bands spread out and separate, until finally nothing is seen but the central bright space. At this stage the width of the slit is about one or two hundredths of a millimeter. It will be observed that the light has acquired a faint bluish tint. If a Nicol prism be placed between the slit and the eye, and the prism be rotated, it will also be found that the light shows traces of polarization. Further, when the light is faintest, the bluish tint is most decided. On still further diminishing the width of the slit, the bluish tint becomes more apparent, and on applying the Nicol prism the polarization is quite decided, the tint when the light is faintest being deep blue. When the width of the slit has been reduced to about 0·001 millimeter, the tint changes to violet, the polarization appears to be complete, and on turning the prism the tint becomes a more decided violet, until finally the light disappears. If the prism and the slit be interchanged, the same results follow in the same order as before. The material of which the edges of the slit are composed does not seem to affect the result. Slits made of iron, brass, and obsidian were employed. With the latter more perfect results were obtained than with the others, probably, however, because the edges were more perfect.

This experiment, Mr. Michelson said, may be varied, and the results shown in a very striking manner, by using a double image prism, when the two images may be compared side by side. The experiments are trying to the eyes on account of the faintness of the light. The conditions under which the phenomena may be best observed are: 1. The sun to be observed directly, holding the slit as close as possible to the eye. 2. A double prism is to be employed, so that the faint and the bright images may be observed side by side. 3. The width of the slit should be between the one hundredth and one thousandth of a millimeter. 4. The edges of the slit should be as nearly perfect as possible. The explanation has suggested itself that the polarization may be accounted for by considering that the greater part of the light which reaches the eye has been reflected from the edges of the slit.

The fact that the plane of polarization is at right angles to the length of the slit would seem to confirm this. The objections to this explanation are: First, that there should then be a difference in the behavior of different materials. Second, the polarization should be exhibited when the slit is wide as well as when it is narrow. These experiments seem to prove, first, that light in passing through a very narrow slit is partly or completely polarized in a plane at right angles to the slit; second, that such a slit allows the shorter waves of light to pass more freely than the longer ones.

It is proper here to express our indebtedness, in making these gleanings, to the ample reports of the papers read, published by the New York *Times*, the only one of our great dailies that paid any attention to the meeting of the Academy.

The Berlin Fish Show.

The International Fishery Exhibition, which opened in Berlin April 20, has proved a splendid success; and it is gratifying to read in the German and English reports that the exhibits sent out by the United States form in every respect the most remarkable collection in the Exhibition. The floating hatchery "Fish Hawk" attracts especial attention.

In his opening address, the German Minister of Agriculture, Dr. Lucius, said that the Fisheries Society, through whose efforts the holding of the Exhibition was due, had met with the most obliging support, not only in Germany itself, but in nearly all the neighboring countries, and even to the furthermost zones of the earth. From the Baltic and the German Ocean, the ice bound seas of the north, from the coasts of Holland and England, from the Switzer lakes, from the exhaustless riches of the Mediterranean, from the Volga and the Black Sea, from North and South America, from the coasts of the far East, from India, China, Japan, and the Malay Archipelago—the fauna of the waters had been brought in rare and wonderful profusion, with an endless variety of pearls, shells, and corals.

A Metallic Shower.

For several hours, on the night of March 29, a fall of rain mingled with meteoric dust occurred at Catania, Sicily. The dust contained fragments of iron, either in a pure metallic state or in metallic particles surrounded by an oxidized crust. The fragments were of many shapes and sizes, and were readily attracted by the magnet. They only differed in size from a shower of aerolites.

Such shows of meteoric dust are probably not infrequent, though it is seldom that they are so clearly indicated in southern lands. In high latitudes they are shown by frequent and well marked discolorations of the earth's snowy mantle in places where terrestrial dust is a practical impossibility.

NEW DRAUGHTSMAN'S EASEL.

It is well known that draughtsmen, engravers, lithographers, and persons having similar occupations, suffer very much on account of the cramped and unhealthy position they necessarily assume while working on an ordinary table. Mr. G. Boudriot, of Hagen, Germany, has invented an easel which avoids the most serious defects of the ordinary draughting table, and is very convenient. It can be adjusted to almost any desired position It is represented in the annexed engraving, taken from the *Leipziger Illustrirte Zeitung*. The drawing board is suspended from two sliding frames by ropes passing over pulleys on the top of the easel, and it is balanced by a ball weight attached to the ropes, as shown in the engraving.

The board can be inclined at any desired angle by means of adjustable telescoping struts. The easel is provided with adjustable arms, carrying sliding carriages, from one of which a lamp is suspended. A small table for the instruments is suspended from the other. The easel can be adjusted to suit persons of different heights and to accommodate different kinds of work. This table is easily constructed, and it seems to be very convenient and well arranged.

IMPROVED DRAUGHTSMAN'S EASEL.

NEW METHOD OF OPERATING MINING PUMPS.

Our engraving illustrates a novel arrangement for supplying power from a central station to a number of contiguous mines. The invention consists in the employment of hydraulic pressure, generated by steam or water power, and one or more pressure accumulators, the water under pressure being conveyed through pipes to the different mines, where it is used for operating pumps, hoisting and blowing machinery. It is then returned through pipes to a water tank, from which it is again pumped into the accumulator to be used over again.

In operating the pumps at the mines a strong bracket is secured to the ordinary spear or pump rods. A ram or upright hydraulic cylinder is placed under each bracket, so that the piston rod of the cylinder will strike the under side of the bracket, and lift the pump rod when the piston rises. A branch pipe is connected with the hydraulic cylinder below the piston. A waste pipe leads from the hydraulic cylinder to a water tank at the central station, from which the water is pumped into an accumulator. A valve is arranged in the length of the branch pipe near the hydraulic cylinder, and another in the waste pipe; and these valves are operated automatically by the motion of the pump rods so as to open and close alternately, thus admitting the water to and discharging it from the cylinders, giving the pump rods a vertical reciprocating motion.

By this means an entire mining district, when the mines are conveniently situated, can be supplied with a cheaper and more reliable power than when separate engines are used, and the mines will at all times have command of a larger surplus of power, because two or more engines can be maintained at the central station, each of which is sufficient for ordinary work, so that in case one should become disabled the other could be used. By this arrangement, should any of the mines strike a body of water suddenly, then at once the surplus power can be drawn to that particular mine to operate upon the surplus water. Should the power still be inadequate it would take but a short time to add another pump to pump into the same accumulator, and thus furnish all the power required by a drowned mine.

This invention was recently patented by Messrs. Moore & Dickey, of San Francisco, Cal.

IMPROVED METHOD OF OPERATING PUMPS.

Strong Hose Pipe.

At a recent meeting of the Edinburgh Association of Science and Arts, a short communication was made by Mr. William Firth on the use of India rubber hose for steam and high pressure purposes, and exhibited a piece of canvas and rubber hose capable of withstanding a pressure of 4,000 lb. to the square inch, and also several other pieces of canvas and rubber packing, which, he said, were most useful for engineers. Several members spoke favorably of the novel points embodied in Mr. Firth's communication.

MECHANICAL INVENTIONS.

Mr. Richard E. Wilcox, of Hartford, Conn., has patented an improved drill chuck, so constructed as to hold the work firmly and allow it to be easily inserted and removed. The work is held by the front ends of the jaws, which are made to open or close by turning the exterior case of the chuck.

An improved spark arrester, patented by Mr. Daniel B. Stalker, of New Petersburg, O., consists of three cylindrical wire screens set concentrically one within another, and fixed in a vertical position on the top of a boiler smokestack, and provided with caps and tubes and other devices for aiding in arresting and disposing of the sparks and cinders that may escape from the stack.

Mr. Harrison W. Holley, of Lynchburg, Va., has patented an improvement on a machine for rolling and cutting tobacco for which the same inventor received letters patent No. 209,808, dated November 12, 1878.

An improved machine for making plug tobacco has been patented by Mr. Edward T. Pollard, of Lynchburg, Va. The object of the invention is to provide means whereby the tobacco may be fed on the inside of a single belt, rolled in a continuous sheet, and cut into plugs; also, to provide means for keeping clean the surface of the large roll over which the tobacco is carried and the inner face of the belt.

Mr. Amos A. Burr, of Rockdale, N. Y., has patented an improved saw so constructed that it cannot be forced forward should its teeth strike a knot or other hard spot in the wood.

An improved wagon brake has been patented by Messrs. John F. Tailey and John M. Wadlington, of Uptonville, Ky. The object of this invention is to furnish brakes for wagons and other vehicles so constructed that they may be applied automatically whenever the horses cease to draw.

Mr. Reuben F. Krohn, of Sunbury, Pa., has patented a simple and effective self-coupler whereby cars can be coupled or uncoupled and the link removed without going between the cars.

An improvement in feathering paddle wheels has been patented by Messrs. Thomas C. Pratt and Herman J. S. Lewis, of Grafton, N. Y. The object of this invention is to furnish paddle wheels which shall be so constructed that the paddles will adjust themselves automatically to bear equally against the water when moving through one part of the revolution and edgewise when moving through the other part of the revolution, so that the most of the power may be utilized for the propulsion of the vessel.

The Little Snow Plow.

Mountain locomotives have two enemies—the falling rock and the snow slide. Both these are successfully vanquished by means of a simple invention termed "the little snow plow." It consists of a concave triangular piece of boiler iron, which fits snugly over the pilot. It is perhaps two feet in height, with a sharp angle in front, and sides which reach backward and outward over the rails. It tosses aside with the utmost ease a foot or two of snow, and so demoralizes an ordinary drift that an engine has no difficulty in passing through. But the peculiar forte of these iron shields is wrestling with huge rocks and bowlders which these warm spring days detach from the mountain sides. Rolling down the slippery banks and lodging squarely upon the track, these savage rocks seem fully bent upon wrecking the trains and landing the passengers in the eddies of the river. The train comes sweeping around the curve all unconscious of the perilous bowlder, and the watchful eyes of the engineer catches a glimpse of the fatal train-wrecker too late to avert the danger. But the little snow plow is wide awake and ready for business. Backed by the ponderous engines and swift-moving train, it catches the rock and hurls it twenty, forty, fifty feet into the air. Rocks that weigh five hundred pounds are thrown as easily as the foot trips a pebble from the sidewalk. Engine 181, with one of these plows, cleared the track of a bowlder which weighed over half a ton. There is no shock which is perceptible to those on the train, but when the next station is reached the heavy iron on the little snow plow is found to be dented as if it had been struck by a cannon ball.—*Truckee Republican.*

Brown Stone as a Fire Resister.

Notice was taken a short time ago of the investigations of Dr. Cutting, State Geologist of Vermont, in determining the relative power of different granites to withstand the action of fire. He has since examined and reported upon the class of building stones known as brown stones, free stones, and sandstones. He found them to withstand heat much better than granite. Of the twenty-three specimens tested, not one was injured at 600°, and only three were slightly injured at 800°. At 900° the effects of the heat were very generally and seriously shown, but so many as seven varieties were reported as "standing well" temperatures even

higher than 1,000° Fah. "Montrose stone," from Ulster county, N. Y., is one of those which stood the test of 1,000°. These investigations were made at the instance of the *Underwriter*.

AGRICULTURAL INVENTIONS.

An improved seed planting machine, patented by Mr. Albert Dart, of Richmond, Va., consists in combining with a seed dropper mechanism a flat rimmed wheel and rim grooved roll, and in arranging a supporting wheel on a two-part shaft between the two sections of a seeder.

An improvement in the class of cotton choppers having one or more hoes operated by a crank or similar means, and working across the rows of plants, or at right angles to the direction in which the machine advances, has been patented by Mr. John T. Sustaire, of Matthews, N. C.

Mr. Benjamin M. Watts, of Phœnix, Arizona Ter., has patented a portable baling press, which is so constructed as to be moved from place to place about a field in which hay has been cut, and bale the hay as it lies in the windrows, where it has been left by the rakes. There is no necessity of bringing the hay to the press or transporting and stacking a quantity in one place, so as to save moving the press. This is the prime or paramount object of the invention, the peculiar combination and construction being such that these results are obtained by the minimum of expenditure of time, labor, and money.

Mr. Robert L. Turner, of Olena, Ohio, has patented an improved hand hoe of that form in which a short handle carries a bent blade adapted to universal use in the cutting away of grass or manipulating the soil about plants; and it consists in the peculiar form of the blade, which is constructed of a main body portion setting off to one side of the longitudinal axis of the handle in a parallel plane therewith, and a curved or upturned end portion, which, as well as the main portion, is sharp upon both edges.

Mr. George Metcalf, of Leland, Ill., has patented a cheap and simple machine for grinding feed for cattle, horses, etc., that is designed more particularly to be operated by windmills having a crank motion.

Mr. Samuel Huber, of Danville, Pa., has patented a plow colter to be attached to the inner or furrow face of the plow beam in such a manner that the colter shall cut the grass from the edge of the turf that is to be turned over by the plow, so that the grass shall not protrude upward between the turned furrows.

Alisoff's Copying Process.

Instead of using a tray filled with a compound to receive the ink, M. Alisoff employs sheets of prepared paper. This polygraphic paper is prepared in the following manner: Sized or unsized paper is coated on one side with a composition consisting of glue, or gelatine, glycerine, soap, and water, approximately in the following proportions, which have been found to give good results in practice: 80 pounds animal glue or gelatine, 20 pounds glycerine, 20 pounds soap, 200 pounds water.

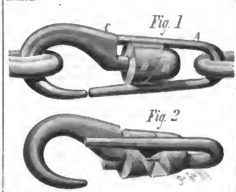
The paper thus prepared may occasionally be found to be too sticky for use, which will depend on the surrounding temperature and the quality of the materials employed. To obviate this objection wash the prepared paper with a solution of alum, the strength of which can only be determined by experiments in each case. The "polygraphic paper" may be of different thicknesses, and if not transparent may be made so, if desired, by any of the ordinary and well known means. The aniline ink, found to give the best results for written documents, is prepared by preference by dissolving about 1 pound of aniline of commerce in about 1½ pounds of alcohol, and adding thereto, when dissolved, as much water as is necessary to render it sufficiently fluid. It may then be bottled for use.

In producing the "matrix" the patentee takes a sheet of prepared or "polygraphic" paper, and lays it on a sheet of damp flannel or cloth placed upon a zinc plate or an oil paper. He sponges it with clean water, or, in hot weather, with water containing a little alum, and places the dry original upon the prepared paper. Over that he places another piece of damp flannel zinc, or oil paper, and puts the whole pile into an ordinary copying press. A good matrix can be obtained by mere pressure of the hands without a press, although a press is preferable. The text must be written, drawn, or printed with aniline ink, taking care that the pen be quite clean and always full of ink. The ink when dry ought to shine like a metallic surface. In taking copies from the "matrix" after having detached the original therefrom, the patentee places a sheet of ordinary paper in the place of the original, and proceeds in the same way as when producing the matrix; but if copies or "matrices" are to be taken from 2, 4, 6, or 8 pages at once he places a sheet of damped "polygraphic paper" on each page with damp flannels and zinc sheets between the leaves of "polygraphic paper," and proceeds in the way above described.

The polygraphic paper may be bound into copying books which can be used like ordinary copying books made of tissue paper, and copies on ordinary paper may be taken from the "matrices" thus preserved, even after a considerable time. After a few copies have been taken the written text can be read from the reverse side of the "matrix," as in ordinary copying books. Should it be found desirable to obtain manifold copies of printed matter this may be accomplished by employing in combination with "polygraphic" or prepared paper, aniline printing ink, prepared in the following manner: Take equal parts by weight of aniline and glycerine and boil them together till the aniline is dissolved, and the composition has attained sufficient consistency to be used in the manner of printer's ink. Ink so prepared will be found particularly useful for printing the headings of letters, bills of lading, declarations, letters of invitation, circulars, and other documents containing both written and printed matter, since if aniline ink be used for both the printing and writing the copies will contain both the printed and written matter, while heretofore only the writing could be copied, the printing ink hitherto employed not being transferable.

NEW SELF-LOCKING HOOK.

We give herewith an engraving of an improved self-locking hook recently patented by Mr. Joel R. Haines, of Mount Laurel, N. J. These hooks are so constructed that the weight of traces or any other tension or strain will hold them so securely locked, so that they cannot accidentally become unhooked.



HAINES' SELF-LOCKING HOOK.

Fig. 1 shows the hook in its normal condition, and Fig. 2 represents it as unfastened.

The two arms of the loop, A, are connected by a collar, B, having on one of its sides two ratchet or clutch teeth, which are engaged by two similar teeth on the head, D, on the shank of the hook, C.

The shank is capable of turning in the collar, B, and as it is turned it is retracted by the action of the inclined faces of the ratchet teeth on the collars, D B, and when strain is put on the hook the tendency of these inclined faces is to turn the hook in the opposite direction.

The ends of the loop, A, are elongated so as to project beyond the collar, B, one arm projecting far enough to nearly touch the point of the hook when locked; the other arm nearly touches the shoulder at C.

Any longitudinal strain tends to keep the hook fastened, and it can be unfastened only by relieving it from strain. This device is applicable not only to harness, but to all kinds of rigging and tackle employing ropes, chains, or straps.

All communications in relation to this invention should be addressed to Mr. Louis T. Derouse, Camden, N. J.

NEW REFRIGERATING COVER.

The annexed engraving represents an improved refrigerating cover recently patented by Mr. Abijah North, of

NORTH'S REFRIGERATING COVER.

Plattsburgh, Clinton County, N. Y. It is designed to be placed over victuals or over dishes containing them, and may be made so small and compact that it may be conveniently used on the table for cooling butter and other articles.

The invention consists of a can having in its lower portion an annular chamber, A, upon which rests a pan, B, which does not quite cover it, and in the pan is placed a basin of perforated metal or wire cloth for containing the ice. The entire device is closed by a cover at the top, and made airtight or nearly so at the bottom by a ring of rubber tubing that surrounds the lower edge of the annular chamber, A. As the ice melts in the basin, C, the water drops into the pan, B, from which it runs into the annular chamber, A. The chamber is provided with a small outlet for air, and with a faucet for drawing off the water accumulating in it.

This refrigerating cover may be placed over small dishes or over articles contained by larger dishes, as shown in the engraving. It will be noticed that both the ice and the ice-cold water resulting from the melting of the ice are utilized in refrigeration.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they will enable the observer to recognize the planets. M. M.

POSITIONS OF PLANETS FOR JUNE, 1880.

Mercury.

On June 1 Mercury rises at 4h. 26m. A.M., and sets at 7h. 21m. P.M.

Mercury is approaching its greatest eastern elongation, and should be looked for after the 15th of the month, in the evening twilight, about 2° north of the point of sunset.

On June 30 Mercury rises at 6h. 34m. A.M., and sets at 9h. 7m. P.M.

Venus.

Venus is approaching superior conjunction, and is so nearly in range with the sun that it is not likely to be seen during June.

Mars.

Mars is more and more distant from us; but its reddish light enables one to distinguish it from the stars.

On June 1 Mars sets at 10h. 30m. P.M.

Mars will be seen near the new moon on the 11th; the moon will pass east of Mars and below the planet in altitude.

Jupiter.

On June 1 Jupiter rises at 1h. 53m. A.M.

It is near the waning moon on the morning of June 3.

On June 30 Jupiter rises at 0h. 10m.

It is in conjunction with the moon; the moon passes north of the planet. This planet is now near enough for us to examine the changes of its satellites.

On the morning of June 22, between 2 and 4, the first satellite and its shadow may be seen on the disk of Jupiter.

Saturn.

On June 1 Saturn rises at 2h. 26m. A.M.

Saturn passes the star Omicron Piscium on the 7th. The star is one degree further north in declination.

On June 30 Saturn rises at 0h. 40m. A.M., closely following Jupiter, about three degrees further north.

Uranus.

Uranus rises on June 1 at 11h. 8m. A.M., and sets at 28m. after midnight.

On June 30 Uranus rises at 9h. 18m. A.M., and sets at 10h. 31m. P.M.

Uranus is moving away from the star Rho Leonis in right ascension, and approaching it in declination. It is about one degree east of the star.

A telescope of four inches aperture will show that Uranus has a pale greenish-white disk; it appears like a very small full moon.

Sun Spots.

The long period of quiet on the sun's surface has ended. The spots follow one another now in rapid succession. A group composed of some dozen spots was approaching the western limb of the sun late in April, when there entered upon the eastern limb a large and densely black spot, surrounded by the usual gray bordering, and accompanied by several others smaller in size. This is undoubtedly a return of that seen about the middle of April; the different members so numerous at that time seem to have united. This spot should be looked for early in June.

Hydraulic Mining on a Railway.

Recently heavy slides of earth seriously obstructed the track of the Central Pacific Railway above Alta, California. The mass of earth to be removed was so great that by ordinary methods several weeks would have been required to clear it away. In the emergency hydraulic miners were called upon for help. They brought up their pipes and monitors, constructed a flume from a ditch which was, fortunately, near at hand, and in fourteen hours piped away a body of *débris* which had been the despair of picks and shovels. The tremendous power of hydraulic mining was thus exhibited in a very practical way. Those who witnessed the swift dispatch of this avalanche of earth have attained, says the Sacramento *Union*, a lively perception of the effects produced upon the bluffs which contain the gravel deposits. It is, indeed, somewhat singular, the *Union* continues, that the hydraulic monitor has never been used in making cuts on railways where the soil is sufficiently soft to be piped. It might be thought that in such cases there would be great economy in the application of water power, for a strong head of water directed by an experienced hand will cut out and carry away more dirt in one day than fifty men could shovel and pick in a week.

AMERICAN INDUSTRIES.—No. 48.

THE MANUFACTURE OF STOVES, RANGES, AND HEATERS.

Perhaps no one thing has contributed so generally and positively to the increased comfort of American homes as the great improvements which have been effected in the stove manufacture within the lifetime of men who are not yet old. The business does not cover all branches of the house-heating service, but it is the most important one, and one in which the products very largely go to supply the wants of the common and middle classes of people. In fact there are none so poor now, in this country at least, but they have the advantages of stove heating to make their apartments comfortable and for cooking purposes, and our mechanics and laboring men generally are now more comfortably protected against the cold in their living rooms than were the richest and most favored a hundred years ago.

For family and office stoves, and for nearly all kinds of ranges, heaters, and furnaces of the present improved construction, the world is indebted almost exclusively to American inventive genius and mechanical skill. German and Dutch stoves of rude contrivance were first used, and Benjamin Franklin made an improvement on these in what he styled his "Pennsylvania fireplace." One of his arguments for them, as given in his quaint language, was: "If you sit near the fire, you have not that cold draught of uncomfortable air nipping your back and heels, as when before common fires, by which many catch cold, being scorched before, and, as it were, froze behind." But we have made great progress in the stove manufacture since Franklin's time, and probably there is not another firm in the country which has been more conspicuously identified with this advancement than that of Fuller, Warren & Co., whose extensive works, known as the Clinton Stove Works, at Troy, N. Y., are illustrated on the first page of this paper. The business of which they are the direct successors was founded over half a century ago, when cooking stoves were in the first stages of their development, and from that time to this the house has occupied a leading position, not only as regards the improved patterns of stoves they manufacture, but in the care and nicety with which the parts are finished and made to fit and work easily. In the latter particular their stoves have always been conceded by the trade to have especial excellence, whether in the cheaper or the more costly kinds.

In our illustrations, the views in the center and on the right hand side at the top show where the patterns are prepared for the moulders, and the flasks made—the latter being the boxes containing the sand in which the moulds are made. But a small portion of the work in getting out patterns is done at the foundry, a huge amount of outside help being constantly employed in this and in getting up new designs. The pattern is first made in wood, and from this a casting is taken, which, after being filed and fitted up with the greatest nicety, is used as a working pattern. These iron patterns are all "bedded," as it is called, or backed up with wood, which is done in the same department as the flask making. One of the most important points in all stove pattern making is to have the patterns of such form and the weight of metal in the various parts so balanced that there will be the least possible liability of the castings to warp and crack with the extreme and sudden variations of temperature to which all stoves are subjected. To guard against this the pattern maker often has to modify designs or change proportions, though it is generally possible to do this in parts of the work which are not seen.

The moulding and casting, which is shown in the view to the left at the bottom, is carried on in four large shops, the buildings for this portion of the work covering two acres and a half of ground. Three cupolas are used daily, from which forty to forty-five tons of iron are run for an average day's work, though the foundry has a capacity sufficient to run as high as sixty tons a day. The best No. 1 American pig is principally used, and two hundred and forty men are employed in this branch of the business. About forty thousand pieces are taken out of the moulds every day. The sand used in moulding is found in large quantities and of excellent quality in the neighborhood. Adjoining the moulding shops is an interior space of about the size of two full city lots, in which are piles of fire pots and rough heavy pieces for heaters and furnaces, where they are placed when taken out of the sand until the other parts are finished. The casting proper, or pouring the metal, is mostly done by carrying the metal by hand to the moulds, but for the large pieces cranes are used to take the molten metal from the furnaces to where the casting is to be made. The running of the metal always takes place between two and four o'clock in the afternoon, the mornings being occupied in preparing the moulds and taking out the castings from the previous day's work.

All the other work, when taken out of the sand, goes to the cleaning room, which is shown in the view to the right in the middle of the page. Thirty men are employed in this department. All of the small pieces, and some of the larger ones, are here milled in drums about the size of a hogshead, revolving at a slow rate of speed, to rub off all of the sand which may adhere to the castings and smooth the rough edges. A great deal of this work is done by hand, which is necessary on most of the large pieces, the men using stiff steel wire brushes. Many machines have been contrived for taking the place of hand work in this department, but no one of them has thus far met with favor in the trade.

The "polishing" room represents the department where the iron work intended for nickel plating is prepared for that process. All such parts, as also the other portions of a stove which are intended to show bright iron without nickel plating, are first ground on emery wheels, and then the parts which are to be nickeled are polished on leather-covered wooden wheels. About one hundred emery wheels are used daily for the finishing of bright parts.

The nickel plating department, as shown in the view on the right at the bottom of the page, represents a portion of the stove making business which was unknown until within the past five years, but during this period the popularity of this style of stove ornamentation has become so pronounced that it is now seen on all classes of work. A large sized Weston electric machine is employed here, and 8,000 to 10,000 pieces are plated per day, requiring the services of fifty men. After nickel plating the pieces are burnished on wheels made of felt and of muslin; the latter consist of enough thicknesses to make the width of the face of the wheel, and the edges of the muslin, when the wheel is revolved at a very high rate of speed, form an efficient burnisher. On some of the stoves now made there are as many as seventy nickel plated pieces.

In the "mounting" room, illustrated in one of the views, the stoves are all put together, the parts being made to fit nicely and work evenly. In the thoroughness with which this final testing of all the preceding operations is done the firm have long had a high reputation. For many years, in their early history, they were the makers of a line of stoves which became celebrated throughout the country, though they have since been to a large extent superseded by more modern patterns.

The designer and patentee of these goods, Mr. P. P. Stewart, gave his entire personal attention to the manufacture, and especially to the mounting, looking over the work in this department every day. It is one of the traditions of the foundry that if he could insert the edge of a piece of paper between an oven door and its frame, the door had to be rehung. The easy working as well as the perfect fit of all dampers and doors and movable pieces of all kinds, is carefully looked after in this department, and when it is remembered that in some of their first-class goods as high as 150 pieces are required in one stove, it will be seen that this is one of the most important divisions of the business. The stoves are all put together before being sent out, except that, in an order for export, it is sometimes, though not often, desired that the parts be packed separately to save freight. In such cases, however, the stoves are all put together at the works, as if for the local trade, and afterward taken apart to box for shipment.

It would require a good deal of space to make even a bare enumeration of all the goods produced by this establishment. They have a wide variety of patterns in some of the best styles ever introduced of stoves, ranges, and heaters, and make, besides, all the tin and copper work required on their premises. What is known as the anti-clinker grate, in stoves for parlor and office use, has met with a good deal of favor during the few years it has been in use. This grate, as is generally known, allows for a space between the upright parts of the fire pot and the grate, in which a poker can be used to remove any clinker that has lodged there. Some of their stoves are made for wood and soft coal, and some for hard coal, while others are calculated for use with either. A large tin shop, not shown in our illustrations, gives employment to fifteen hands; 500 boxes of tin are used here in a year for making stove fittings, with stamping machinery, etc., and for lining reservoirs, oven doors, warming closets, etc. Asbestos and fireproof paint are also used in the linings of oven doors to help retain the heat. Fifty tons of sheet iron are consumed yearly, with a good many tons of sheet copper, used principally for reservoirs. Another considerable department is that in which the japanning is done, in an oven 8 by 14 feet. All the fine pieces go into the oven twice, being carefully coated with a fine brush for the finishing operation. The oven is generally heated to only about 350°, though it is sometimes as high as 500°. All of the bolts and rods used, from five inches up to seven feet long, are made on the premises, but those smaller than this are purchased, although all the door pins used are made in the shop. There is a large storeroom, in which a great stock of stove manufacturers' hardware and supplies is carried, such as bolts, rivets, nuts, oils, paints, varnish, etc., which are issued on requisitions of the different foremen and charged up to the various departments, and the works, which is in what is locally known as South Troy, is connected by telephone with the main office, in the center of the city, from which all its operations are constantly directed.

The general view of the works, in the middle of the page, gives a good idea of their size and capacity. Over 600 men are constantly employed here, besides a large number of outside workmen. A pair of 300 horse power engines, built by William Coutie & Son, of Troy, furnish the power. The premises cover six acres of ground, all of the buildings but the moulding shops being five stories high, and the whole of this space is in constant use for the handling of the immense amount of work all the while going through the establishment. Tracks from the Hudson River, New York Central, Troy and Boston, and Vermont and Canada railroads, run on one side of the foundry, and on the other is the firm's dock on the Hudson river, just opposite the United States Arsenal at West Troy, which may be seen in miniature in the picture. There could not be a more convenient location for obtaining supplies of coal and iron, or for shipping goods, and the iron business has been for so many years a leading feature in that section that almost the whole of the male population have been brought up to and worked all their lives in some one or other specialty of this trade. The stoves made here, besides selling in every part of this country, are exported to almost every quarter of the globe. There is a good demand for them in England, and in Germany, Russia, and Scandinavia; several shipments have been made to Constantinople and other ports on the Mediterranean; some sales have been made in Japan and on the east coast of Asia; a few days ago an order was filled for Australia; and from both the east and west coast of South America considerable trade in this line is now coming here.

Besides their main offices and salesrooms in Troy, occupying three large buildings on River street, they have in New York city, at No. 236 Water street, salesrooms and a large stock of goods always on hand. In Chicago they have an immense warehouse located on the North Pier, and connected by telephone with their offices and salesrooms at No. 56 Lake street. In Cleveland, Ohio, their warehouse and salesrooms are located in the three commodious buildings known as Nos. 76, 78, and 80 River street. And a large stock of their wares is kept at Omaha, Neb., for rapid distribution, by Milton Rogers & Son; and from these central points they are enabled to make distribution of goods with great promptness and dispatch.

Photographic Novelties.

PHOTOGRAPHY APPLIED TO THE BIOSCOPE.

The London *Photographic News* reports the following most recent novelties in photographic discovery. M. Eugène Simmonar has invented a kind of bioscope, in which a portrait is shown with the eyes sometimes open, sometimes shut. The illusion of the same person alternately awake and asleep is very perfect. To obtain this effect, the inventor takes a double photograph of a sitter in exactly the same position, only in the first the eyes are open, in the second closed. From these two negatives prints are taken, one on the right side, the other on the reversed side of the same sheet of paper, in such a way that the two images, when viewed by transmitted light, accurately coincide; this can easily be done by the carbon process. By means of a small instrument arranged for the purpose, the light and reversed sides of the paper are alternately illuminated, and the face is seen with the eyes successively open and shut. Thus the illusion of a person rapidly winking can be perfectly produced.

PHOTOGRAPHIC TOY.

M. Lipman has applied an analogous principle to the production of trinkets, in which are set two photographic miniatures, something similar to those which M. Dagron used to make many years ago. For example, one of the miniatures represents a lady holding her opera glass to her eyes, the other a portrait of the same lady without the glass. By means of a small button acting on a reciprocating motion, one image may be rapidly substituted for the other, and a very good illusion is obtained of the figure raising and lowering the opera glass. Effects of this kind are susceptible of any amount of variation. A large number of highly interesting applications of a similar description would appear to be open to gelatino-bromide plates, especially as their superior over wet collodion plates, as regards sensitiveness, increases enormously the facility for obtaining the desired result.

Steam on the Upper Delaware.

The steamboat Kittatinny, the first that ever reached Port Jervis, N. Y., returned to Delaware Water Gap April 28, without accident, having run the 50 miles in less than five hours. The Kittatinny is 60 feet long, 14 wide, and can carry 70 passengers. The Port Jervis *Union* does not think that the attemp to navigate the Delaware to that point will be permanently successful. It says: The opening the Delaware to steam navigation would uncover one of the most delightful regions in this country. The scenery along the river is grand and picturesque in the extreme. Every mile presents some new and wonderful panorama, and thousands of those who go to the Catskills and Adirondacks for wild landscapes would spend their seasons in this valley if once its beauties were made accessible. The Lehigh and Eastern Railroad will do something toward increasing the travel in this valley, but nothing will ever quite equal the advantages that would be offered by a line of steamers plying between Trenton and Port Jervis. We would like to see all the difficulties removed, and the daily arrival and departure of steamboats to and from Port Jervis; but we know that so long as the Delaware remains a mere big mountain torrent, with treacherous rocks and foaming shoals, the thing cannot be accomplished.

Fall of Meteoric Dust.

Professor Silvestria, of the Catania Observatory, reports the fall, on the night of the 29th of March, of a shower of meteoric dust, mingled with rain. Besides the usual characteristics of color, chemical composition, and the mixture of mineral and organic particles and minute infusoria, there was a considerable proportion of iron, either in a purely metallic state or in metallic particles, coated with oxide. The size varied from a tenth to a hundredth part of a millimeter, and the form was either irregular or spherical, as if it had undergone fusion. This phenomenon was first observed in the Indian Ocean, south of Java, in 1859, and has been corroborated by Professor Nordenskjöld's Arctic observations.

The Self-leveling Ship's Berth.

A special exhibition of the Huston self-leveling berth was given on board the Havana steamer City of Alexandria, April 28. This berth is so hung and balanced as to maintain a level surface whatever may be the rolling or pitching of the vessel. By this means two sources of discomfort during sea-voyages are materially overcome. The new berths are placed like ordinary berths, and take up but little more room; and while they must necessarily partake of the larger motions of the ship they are quite free from sudden pitching and rolling. Many who have used them at sea testify to a complete exemption from sea-sickness while occupying them. And to those who do not suffer from this distressing malady their advantages would seem to be scarcely less marked. They are so well balanced, and keep their level so surely, that their occupants can lie at ease, with no risk of being thrown out by a sudden lurch of the ship. Any one who has been tossed about in an ordinary berth will appreciate the luxury of a level and steady sleeping place during rough weather.

Was it Wind or Lightning?

A suit has been brought in the Circuit Court at Madison, Wisconsin, to collect from an insurance company for damages done by the great storm of 1878. The property was insured against lightning, and the company resist payment on the ground that it was destroyed by wind. The plaintiff hopes to prove by the evidence of members of the Signal Corps that the whirlwind which destroyed his house was of electrical origin. A vast amount of insurance is likely to be affected by the decision of this case, owing to the heavy losses of property during the recent whirlwinds.

River Scenery of Alaska.

Alaska is covered with a network of deep, cool, perennial streams, that flow on, ever fresh and sweet, through grassy plains and mossy bogs and rock bound glacial cañons, telling everywhere, all the way down to the sea, how bountiful are the clouds that fill their ample fountains. Some thirty or forty rivers have been discovered in the Territory, the number varying, as the smaller ones have been called rivers, or creeks, by the mapmakers. But not one of them all, from the mighty Yukon, 2,000 miles long, to the shortest of the mountain torrents falling white from the glaciers, has thus far been explored. Dall, Kennicott, and others have done good work on the Yukon, and miners, trappers, and traders have been over most of the region in a rambling way, and each have brought in detached bits of river knowledge, which, though too often misty and uncertain, have been put together in maps that are better than nothing.

The coast line in particular, with the mouths and lower reaches of the rivers, has been fairly drawn, but their upper courses are in a great part invisible, like mountains with their heads in a cloud. Perhaps about twenty of the Alaska rivers are a hundred miles or more in length. The Stickeen is, perhaps, better known than any other river in Alaska, because of its being the way back to the Cassiar gold mines. It is about 350 or 400 miles long, and navigable for small steamers to Glenora, 150 miles, flowing first in a general westerly direction through grassy undulating plains, darkened here and there with patches of evergreens, then curving southward, and receiving numerous tributaries from the north, it enters the coast range and sweeps across it to the sea through a Yosemite valley more than a hundred miles long, and one to three miles wide at the bottom, and from five thousand to eight thousand feet deep, marvelously beautiful and inspiring from end to end. To the appreciative tourist sailing up the river through the midst of it all, the cañon for a distance of about one hundred and ten miles is a gallery of sublime pictures, an unbroken series of majestic mountains, glaciers, falls, cascades, forests, groves, flowery garden spots, grassy meadows in endless variety of form and composition—furniture enough for a dozen Yosemites—while back of the walls, and thousands of feet above them, innumerable peaks and spires, and domes of ice and snow tower grandly into the sky. Sailing along the river the views change with magical rapidity. Wondrous, too, are the changes dependent on the weather. Avalanches from the heights, booming and resounding from side to side; storm winds from the Arctic highlands, sweeping the cañon like a flood and filling the air with ice dust; rocks, glaciers, and forests in spotless white.

In spring the chanting of cascades, the gentle breathing of warm winds, the opening of leaves and flowers, birds building their nests, hundred acre fields of wild roses coming into bloom, and tangles of bramble and huckleberry, swaths of birch and willow creeping up the lower slopes of the walls after the melting snow, massive cumuli piled about the highest peaks, gray rain clouds wreathing the outstanding bows and battlements of the walls. Then the breaking forth of the sun on it all; the shining of the wet leaves, and the river, and the crystal spires of the glaciers; the looming of the white domes in the azure, the serene color grandeur morning and evening, changing in glorious harmony through all the seasons and years.—*San Francisco Bulletin.*

APPARATUS FOR REGISTERING SOLAR RADIATION.

Solar radiation is an element which undoubtedly plays a considerable of a *rôle* in meteorological phenomena, and several methods have been employed to automatically register the period during which the sun is shining, the interruptions to radiation caused by clouds, etc. The Meteorological

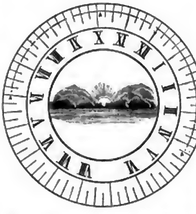


Fig. 2.—TRACING MADE BY APPARATUS FOR REGISTERING SOLAR RADIATION.

Observatory at Kew has in operation an apparatus designed for such a purpose by Campbell. It consists of a glass globe filled with water, forming a lens, and so arranged as to carbonize a strip of paper by concentrating the sun's rays when they traverse the atmosphere. An English physicist, Mr. David Winstanley, has remarkably improved on this system. His apparatus consists of a differential thermometer, T T' (Fig. 1), mounted on the beam of a balance, as shown in the accompanying engraving.

The two bulbs of the thermometer, T T', are covered with lampblack. The bulb, T, to the left is alone exposed to the open air, all the rest being inclosed in a box. When the sun shines the air contained in the bulb, T, dilates, and the mercury in the differential thermometer is driven into the tube, thus destroying the equilibrium of the balance. The beam then inclines, and the point of the pencil, which is fixed to the support, F, rests on a paper circle fastened to a copper disk. This disk keeps constantly revolving on its axis, carrying with it a paper dial like that represented in Fig. 2. When the sun is no longer shining the balance resumes its equilibrium, the pencil ceases to touch the paper, and the tracings made by it are thus broken.

In Fig. 2 the line, A A A, represents what was inscribed by the registering pencil on the 1st of September, 1879. It will be seen that the sun shone from 6 to 7:30 o'clock in the morning; and that from 7:30 to 8 o'clock clouds intervened several times, since the line is broken. In a like manner may be seen the duration and interruptions of radiation up to 4:15, when it was definitely arrested for that day. To complete the description of this ingenious apparatus we will add that the metallic balls, A B, are provided with screws, and serve to place the beam in equilibrium. The rods, C D, are made of metal, and are designed to prevent oscillation.

APPARATUS FOR REGISTERING SOLAR RADIATION.

The tracing, which is reproduced reduced one half, is a specimen of such as the inventor obtains at his Douglas Observatory in the Isle of Man.

The New Oil Pipe Line.

Describing the oil pipe line now being pushed toward the seaboard, the Hornellsville *Times* says: Its beginning is near Bradford. It pursues a straight line to the east that, if continued, will bring it out near Catskill on the Hudson River. It may bend to the southeast to strike water at New York. It is generally considered that this line is intended to convey oil to the seaboard or some river convenient thereto. By whom it is being pushed through is a puzzle. Report says the project is advanced by the Union Tank Line Company. This is undoubtedly a branch or only another name for the Standard Oil Company.

The cost of the undertaking cannot be estimated, but that it is a gigantic enterprise and will cost a vast sum may easily be shown. The tanks at Cameron Mills will cost nearly $10,000. Each of the pumps will weigh sixty-five tons, and will cost $16,000 or more. The engines will consume five to ten tons of coal per day. The pipe is wrought iron and costs $1.20 a foot. Add the cost of surveying, clearing away, laying the pipe, burying it, engine buildings, and a score of other things, and the expenditure, were it known, would seem fabulous.

A new telegraph wire has been put up along the railroad, and a report of progress at various points is daily wired to headquarters. When the line is in operation a full report of the business at each station will daily be telegraphed to the proper officials. Every length of pipe is numbered, and is checked off when put on and taken off of the cars. It is receipted for by the teamster and again by the men who lay it. Every detail in this great scheme is watched and properly recorded and reported.

Chinese Sheet Lead Factories.

The manufacture of sheet lead for the lining of tea chests is an important industry at Hong Kong. The melted lead is pressed into sheets by hand between pairs of large paving tiles smoothly covered with several layers of unsized paper. As he drops the melted lead on one tile the workman quickly presses it into a sheet with the other. The paper being a bad conductor of heat, the lead does not solidify immediately it leaves the ladle; and as by long practice the workman always ladles out exactly the same quantity of lead, the sheets vary but little either in size or thickness. The sheets are afterwards trimmed by hand with large shears.

A New Process for the Treatment of Sulphureted Ores.

A new method of treating gold-bearing sulphurets, by which such ores can be reduced, it is said, at a cost not exceeding $4 a ton, has lately been developed and tested in Philadelphia. The *Record* describes the process as follows: The ore is first passed through a powerful rock-breaker, in which it is broken into small pieces. From here it goes into a pulverizing machine, where it is reduced to grains so fine that they will pass through a sieve running 3,600 holes to the square inch. Thence it is put into the ore roaster. This is the chief feature of the process. It is composed of fire-clay retorts of cylindrical shape, built one above the other in four tiers, the entire structure being fifteen feet high, eight wide, and twelve deep. The heat in the retorts varies, the lower one being the warmest and the upper the coolest. The powdered ore is passed into the rear of the top retort, and is moved slowly along by means of a comb worked by machinery until the front is reached; thence it falls into the retort below, then moves back, and the operation is repeated until the last and bottom retort is reached, when it passes out, the whole operation consuming about four hours. By this process the sulphur is burnt out of the ores, the base metals are oxidized, and the gold is left in a free metallic state.

After this the ore, having been cooled, goes into an automatic amalgamator. Here it is treated with hot fumes of mercury, which instantly attach themselves to the precious metals and amalgamate every particle of the free gold in the ore. By the other processes numberless small pieces of gold, which have not gravity enough to attach to the plates, float away and are lost. With the use of hot mercury, however, these small particles are rolled into globules and are consequently saved. Again, when ordinarily treated, small portions of gold become coated with copper and iron, and are thus lost. In this process, however, such a coating is stripped off by the action of the hot mercury, a condition of amalgamation which is never accomplished when cold mercury is employed.

After passing from the amalgamator the ore is thoroughly cooled and then thrown into settling pans filled with water, which are kept agitated for the purpose of settling the quicksilver containing the gold. This is next placed in a retort, where the mercury is separated from the precious metals.

The Canadian Canal System.

The Canadian canal system now comprises the following sections: First, the Welland Canal from Lake Erie to Lake Ontario. Thence the route is across Lake Ontario itself to Kingston, where the navigation of the river St. Lawrence begins. As is well known, remarks a *Herald* correspondent, sent especially to study the Canadian canals, this river along its upper portion, owing to numerous rapids, is unfit for continuous navigation. Hence at various points these rapids are avoided by canals, the vessels passing back from them to the river. These are the Galop Canal, the Rapide Plat Canal, the Farran's Point Canal, the Cornwall Canal, the Beauharnois Canal, and the Lachine Canal, where the river is reached at Montreal, and ocean navigation begins. When it is remembered that the Erie Canal is 350 miles long to Albany, and has 72 locks, a table showing the superiority of the Canadian route in the matter of plain sailing will be instructive, since with 365¼ miles it reaches ocean navigation:

	Canal Navigation. Miles.	Free Navigation. Miles.
Welland Canal	27	—
Lake Ontario	—	160
River St. Lawrence	—	66⅝
Galop Canal	7⅝	—
River St. Lawrence	—	4½
Rapide Plat Canal	4	—
River St. Lawrence	—	10¼
Farran's Point Canal	¾	—
River St. Lawrence	—	5
Cornwall Canal	11½	—
Lake St. Francis	—	28¾
Beauharnois Canal	11¼	—
Lake St. Louis	—	15¾
Lachine Canal	8½	—
Totals	70⅝	294⅝

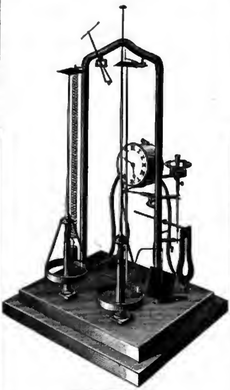
From Lake Erie to Montreal, 365¼ miles.

This route has only 54 locks. It can accommodate vessels of nearly three times the tonnage of those on the Erie Canal. It can remain open to navigation about the same length of time. It has 9 feet of water in the lowest of its locks, against 6 feet in those of the Erie Canal. This refers to the Canadian water route as it is.

As the Canadian water route is intended to be these already superior conditions will be greatly increased. To begin, the minimum size of the locks is to be 270 feet by 45 feet, with 14 feet of water on the miter sills. The enlargement of the Welland Canal will shorten the distance one mile, with one lock less besides. At the Galop Rapids it is proposed by submarine operations to lower the bed of the river from 10 feet to 16 feet, so that vessels descending need not pass through the Galop Canal at all. A contract has been issued for this work. The entire system of river and canal navigation is to be made available for vessels drawing 14 feet, dredging in the former case being necessary. No clear sketch of the work has been completed yet, and all the prospective benefits remain therefore unrealized.

APPARATUS FOR RECORDING EARTHQUAKE MOVEMENTS.

The accompanying cut, taken from *La Nature*, represents an ingenious seismograph invented by M. Ignazio Galli, of the Meteorological Observatory at Velletri, Italy. It con-



GALLI'S SEISMOGRAPH.

sists of six separate devices for observing and recording automatically the horizontal and vertical amplitude of earth tremors, the direction of the earthquake movement, the time of the shock, and the intensity of the attending magnetic disturbance. At the nearest corner of the marble base is a short standard of metal, on the top of which rests an agate cap, balanced by a metal ring below, and carrying above a long, slender vertical rod, the whole forming a sensitive pendulum. At the top of the rod is a small silver mirror, carrying a fine needle, the movements of which are observed through a small telescope. Any movement of the base is so magnified at the upper end of the rod that the minutest tremors of the earth are thus made visible.

The system next to the left is substantially the same, save that the vertical rod is shorter and carries at top a sheet of paper covered with lampblack. Resting on this blackened paper is the fine needle of a nicely balanced lever attached to the brass support which arches over the middle of the base. As the earth tremor causes the paper to move the relative extent and character of the movement are marked by the needle on its blackened surface. Behind this part of the apparatus is a weight suspended by a sensitive spiral spring. At the bottom of the weight is a lever, to the other end of which a needle is suspended by a hair, the point of the needle resting on a sheet of blackened paper slightly inclined. This is for measuring the vertical height of the earth movement. Its operation is obvious.

The direction of the movement is marked by the needle of the lever attached near the upper right hand corner of the frame, on the sheet of blackened paper on the top of the rod which rises from the middle of the base.

To ascertain the quarter whence the movement proceeds and the time of the shock, a truncated metal cone is inverted and balanced on a horizontal metal disk surrounded by a ring marked with the cardinal points. The instant the apparatus is moved the cone tips against that side of the ring whence the motion proceeds, and in falling sets upon a lever which stops the clock, thus indicating at once the direction of the source of the shock and the time of its occurrence. The intensity of the accompanying magnetic disturbance is measured by the magnet and its attachments. This seismograph is inclosed in a glass case, is small, extremely sensitive, and records the slightest tremors of the earth with great precision.

MISCELLANEOUS INVENTIONS.

An easel for holding drawing boards and other similar articles, which is so arranged that the board or other article can be set in a horizontal position or at any desired inclination, and can also be revolved so as to present the drawing or other object in different positions for the purpose of facilitating the work on the object, has been patented by Mr. Isaac Wilkins, Jr., of Greenpoint, N. Y.

An improved scarf, which can easily be changed so that either end of it may be attached to the neck band, has been patented by Mr. Werner W. Fichtenberg, of New York city. Both ends of the scarf are alike, and provided with a neck band having its end fastened to a small plate, which is pivoted to a button that is arranged to slide on a thin rod or a wire fastened to the rear side of the scarf.

Mr. John T. Rossetti, of Brownsville, Texas, has patented a pendant for a watch which can be turned in every direction and can be screwed into the watch case. The pendants made heretofore could be turned forward and backward in one direction only, and were not screwed into the case, but soldered to it, and were liable to break off.

Mr. Samuel M. Rhoads, of Jeffersonville, Pa., has patented a simple and durable shaft or pole coupling for vehicles. The invention consists in combining with the cushion of a thill coupling a box having a recess and back piece, a separate axle clip, and a screw-threaded cap having ears that clasp the box.

An improved corset clasp, patented by Mr. William McCabe, of New York city, consists in forming the hook plate with a spring tongue to prevent the accidental separation of the hooks and eyes after they have been fastened.

Mr. Charles H. O'Connor, of Brooklyn, N.Y., has patented a process for the manufacture of flexible non-inflammable paper, or for the treatment of paper to render it non-inflammable; that is to say, saturating paper wholly or partially unsized with a solution of silicate of soda of low specific gravity, and subsequently drying the paper.

Mr. John B. Weir, of Otsego Lake, Mich., has patented an improved calk plate for boots and shoes which is both simple and effective. It consists of a metal plate covering the heel and sole, provided with calks on the lower side and lugs, which fit into corresponding recesses in the sole on the upper side. It is secured to the heel of the boot or shoe by means of a countersunk screw, which takes in a threaded plate and socket in the heel.

Mr. Thomas B. Baldwin, of Troy, Pa., has patented a parlor cooking stove with two fireplaces, so arranged that the one may be used simply for heating purposes, and the other be used simply for cooking purposes.

Mr. Robert Cunningham, of Brooklyn, N. Y., has patented an improved process of ornamentation, consisting in fixing the ornament in the desired position with some suitable adhesive substance or fastening, and then pouring over the entire surface of the ornament and its support a sufficient quantity of transparent alcohol copal varnish to cover and imbed the ornament.

NEW SPORTING GUN.

Until quite recently guns of the class shown in our engravings were imported, but we are now able to produce on this side of the Atlantic guns that are not only fully equal to the best English make, but also a great deal cheaper.

The gun shown in our engravings is unquestionably one of the best breech-loading sporting guns in market. It is manufactured at Colt's armory by the best and finest machinery, and is as good a specimen of mechanical work as one would wish to see. The parts are interchangeable, and so accurately made that parts of different guns may be intermixed and a gun may be put together from parts taken haphazard. The lock is of the rebounding style, and the firing pins are without springs. The entire mechanism is exceedingly simple, yet each part performs its office perfectly.

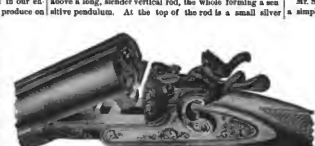


FIG. 2.—COLT'S DOUBLE BARRELED BREECH-LOADING GUN.

The action bolt, A, which retains the barrel in its place, is moved by a lever, B, through the medium of internal parts not shown in the engraving. This bolt engages two hooks on the barrels and retains the barrels rigidly in place.

The bolt, C, carrying the shell extractors is engaged by a cam, D, on the bolt, connecting the stock and the barrel, and when the barrel is released by drawing the action bolt, A, and tipped as shown in Fig. 1, the shell extractor is operated.

The stocks to these guns are made of any desired style of English or Circassian walnut or other choice wood, and the guns can be furnished with any grade of finish. Patterns are furnished with the guns if desired, and the guns are guaranteed to make the pattern furnished. Each gun is thoroughly tested at the factory, and none but absolutely perfect ones are placed on sale.

We have recently examined samples of these fine guns from the establishment of Messrs. Hodgkins & Haigh, 300 Broadway, New York city, who keep an assortment of them on exhibition and for sale.

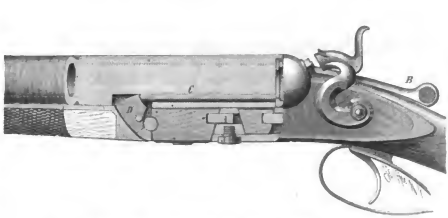


FIG. 1.—LONGITUDINAL SECTION OF BREECH-LOADING SPORTING GUN

THE DECORATING SPIDER CRAB.

A. W. ROBERTS.

Society and occupation in the world of the sea are represented by masons, builders, marauders, usurpers, and plunderers, and all have their distinguishing peculiarities. A fancy of the quaint spider crab, or "dandy crab," as he is sometimes called, is to decorate himself with algæ and sponges; and none but the most brilliant in color seem to please him; this, however, not for vain display, but, primarily at least, for personal protection. He moves about "slowly and solemn," and is deliberate in decision and determined in purpose; his hard, spiny shell, of somber color, adds to the dignity of his appearance, and the methodical way in which he uses his claws and carries himself about, really impresses one with the idea that he is quite an important personage in the aquarium.

When wishing to array himself he finds a brilliant algæ or sponge, and pinches off piece after piece with his long, slender claws; these, when broken, are dipped in a glutinous fluid contained in the mouth, and are carried to the back and fastened securely. Sometimes after he has attached a particular fragment, he reaches back his claw a second time to satisfy himself that it is secure.

This practice is indulged in only when the crabs are young, and in the fall, and its object is to obscure the crab from hungry sturgeons and skates. When placed in a tank with many animals the crabs take the same precaution against possible enemies, and often cover themselves.

Full-grown crabs are too large and hard to be swallowed, and are seldom seen fastening seaweeds to their backs, as they no longer have need of such protective covering.

THE DECORATING SPIDER CRAB

There is an old mill race on Long Island where many of these crabs have been carried among sponge-covered rocks whence they cannot return. Dainty bits of red and yellow sponges have been attached to their backs, which have grown so as to nearly cover them. When in motion the crabs look like moving sponges. Although much preferring brilliant algæ and sponges, the spider-crab will, for lack of them, make use of other material. Not long ago a tank was cleaned in the aquarium, and a spider crab was confined in one corner with a pane of glass. I threw in sprays of sertularia and bits of the bases of anemones. These were eagerly seized by the crab and attached to his back. In course of time the bits of anemones developed into perfect animals, and remained on the shell till the crab reached the period of casting.

The spiders cast their shells like the rest of crabdom, but unlike other varieties have no attendant to protect them when soft. Two that were nearly ready to shed in one of the tanks at the aquarium, suddenly broke loose from their shells on the tank's receiving a sudden jar. The crabs are less pugnacious than the hermit and other crabs, appearing to quarrel only over their food. They have keen appetites and good noses for scenting food. I have often amused visitors at the aquarium by holding a dead minnow in my hand. The crabs would assemble from all parts of the tank, and climb up my arm and cluster about my hand in numbers in search of the minnow, after having fierce contests with one another.

More curious than this is the fact that they will deliberately seat themselves on the largest sized anemone when feeding, and with their claws will deliberately take the food out of the stomach of the anemone.

I have often seen the spider crab attack a scallop in open shell. The scallop would close suddenly and hold the crab captive for several hours.

There is a specimen of the long-armed spider crab of Japan in the cabinet of Rutgers College, N. J., which measures, when the limbs are extended, eleven feet and six inches. This variety is the largest known.

THE PAINTED TURTLE.

C. FEW SEISS.

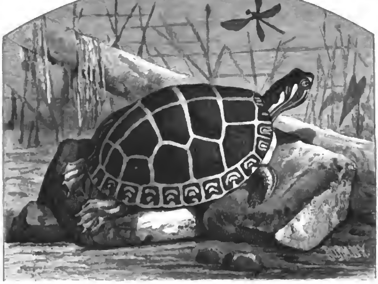
The painted turtle (*Chrysemys picta* (Herm.), Gray) may be found in many of our ponds, lakes, creeks, and rivers, from New Brunswick to Georgia. A naturalist says: "It inhabits stagnant ponds or lakes, and is never found in rivers or running streams." This is an error. I have seen it and seen it captured in the Delaware and Schuylkill rivers, and also in various creeks of running water.

In Pennsylvania, April is the month in which it generally awakens from its winter nap, and quits its dark dormitory of mud to enjoy the spring sunshine. It may sometimes be seen floating on the surface of the water, with legs extended, and its head just partly drawn within its shell, but sinks quickly at your near approach.

It is generally supposed that turtles do not have a note or song, or produce any sound except a hiss, given when the head is suddenly drawn back within the carapace. But the painted turtle has a love song which he often sings during May. It is something like the shrill note of the toad, but cannot well be described. About the first of June the female quits the water and digs a hole in the ground, in which she deposits her eggs. They then appear to receive no more attention, but are hatched by the temperature of the soil. The young turtles make for the water as soon as hatched. They are truly pretty little things: indeed I may call them "real 'cute."

I cannot say what this turtle principally feeds upon in a wild state, but in captivity it devours meat, fish, tadpoles, earthworms, and also berries.

The painted turtle, though not considered eatable, is nevertheless sold along with several other turtles, and figures as a "diamond-back" in the famous terrapin supper. Indeed in some seasons there are more wood turtles (*Chelopus insculptus*, Le Conte) and red-bellied turtles (*Pseudemys rugosa*, Shaw) sold in the Philadelphia markets than edible salt water terrapins or diamond-backs (*Malacoclemmys palustris*, Gmel., Gray) The game dealers call the female turtles "cows," and ask higher prices for them than the "bulls," as they are generally fatter, and often contain eggs. I examined a netful of terrapins at a game store a week or two ago, and found them all to be of the *rugosa* species. Many of them were dead, and two were so "*very* dead" that their eyes had dried up and sunk deeply into their sockets. And yet the wily caterer will buy them and stew them with wine and spices, and the epicure will smack his lips over this reptilian carrion, and exclaim, "How delicious!"



THE PAINTED TURTLE.

The painted turtle may be recognized by its smooth carapace, the large plates of which are dark olive or greenish black, margined with yellow, and the marginal plates with internally red markings. The plastron (under shell) is of a bright yellow color; sometimes, though rarely, it has a few dark spots. The head is black, with two or more spots on the sides; the neck marked with yellow lines. The legs are streaked with red and black. When full grown it measures from six to eight inches.

The Education of Wild Beasts.

The veteran animal tamer, Alfred Still, says that too much whipping makes a wild animal sulky and vicious, but a certain amount of whipping is necessary. To train a wild beast, he said recently, you must "first make its acquaintance from the outside of the cage, and get the animal acquainted with your face; but, above all, with your voice. They become accustomed to voices sooner than faces, and are governed more by sound than by sight. Having got accustomed to your beasts, and they accustomed to you, your next step is to train them to their tricks. Though these tricks are simple, they require a great deal of time and patience and a good deal of whipping to accomplish them. The lions are the smartest of the wild beasts. You can train a lion to do the ordinary tricks of the trade: jumping through hoops and over gates, standing on his hind legs, and so on—in about five weeks' constant work. It will require about a week longer to teach a lioness, and a leopard, which comes next to a lion in intelligence, about six weeks to learn the same feats. It takes about seven or eight weeks to teach a tiger, and a tigress from eight to nine weeks, while you can keep on beating and teaching a hyena for four months before you can do much with him. The most difficult thing to do is to teach a wild beast to let you lie down on him without his trying to make you lie *in* him by eating you up. Kindness—that is, anything but ordinary civility—is absolutely thrown away upon a wild beast. With a tiger or tigress especially all affection is literally wasted. A tigress is as likely to eat you up after an intimate acquaintance of six years as one of six weeks. As a rule, the whip is the most efficacious instrument for training. It can be used quickly and it hurts. If I were to drop my whip the beasts would fancy I had lost all my power over them and would pounce first on the whip and then go for me. The four tigresses trained in that cage are estimated to be worth $32,000; but a good tiger, unbroken, is not worth more than $2,500. Lions are worth about $3,000 to $2,500 each; panthers, $600; jaguars, $400; hyenas, $250, if untrained; leopards, $350 to $400, according to their kind."

Wild Pigeons in Michigan.

A correspondent of the Detroit *Post*, writing from Traverse, Mich., April 24, says that the biennial flight of pigeons to the woods of Northern Michigan began the latter part of March. These birds on their journeyings from the South to the far North stop every two years for two or three nestings in Michigan, usually coming in immense numbers. On the alternate years, when beech nuts are not abundant in this State, they take some other course in their northward flight. Formerly their first nesting was in Allegan or Ottawa county. Of late they have generally settled first in Shelby, Oceana county, and later in the season in Benzie and Emmet counties. Two years ago they skipped both Oceana and Benzie counties and nested first in Emmet, near Petoskey. This year their first flight was to the same section, but they soon discovered that they had been fooled by the warm weather further south. The weather about Petoskey was still cold, the bay was frozen over, the snow was deep in the woods, the prospect for good feeding was bad, and after a day or two of apparent irresolution and many erratic flights the birds, as if by common consent, took their course to the neighborhood of Platte River in Benzie county. As a local publication stated at the time, "they came in clouds, millions upon millions. It seemed as if the entire world of pigeons was concentrating at this point. The air was full of them and the sun shut out of sight, and still they came, millions upon millions more." They spread over an area of more than fifteen miles in length and six to eight miles wide, and the prospect for a time was

that the nesting would be the most extensive ever known in the State. The news speedily reached all parts of the State, and it is said that in a fortnight's time three thousand hunters—professionals, amateurs, greenhorns—had invaded the country from all directions, surrounding and penetrating the nesting grounds.

It was noticed, however, by old hunters that the birds did not settle down to domestic life as quickly as usual. The roosting birds—that is, those who had not yet mated—outnumbered the nesting birds a hundred to one. Some of the more zealous and inconsiderate sportsmen entered the nesting woods and commenced popping away at the nests themselves, a snow storm followed, high winds prevailed, and many of the roosting birds, disgusted, postponed their anticipated housekeeping, and scattered. The nesting consequently falls far short in magnitude of what was at first expected, though still large in area and containing millions of birds. It scattered along the banks of the Platte River, the townships of Almira, Zeeland, and Homestead. The distance from one end to the other is over ten miles, and the width varies from a few rods to three or four miles. There are, however, numerous long distances between the two extremes where no nests are to be found, and the birds have occasionally changed their ground, so that many of the hunters themselves are very uncertain as to the exact whereabouts of the birds at the present time. In the nests first made the young are about ready to fly, and have been abandoned by the old birds, and in some places, owing to the winds and the constant shooting, the nests have been deserted before any birds were hatched.

One nesting is about the same as another, and the first nest you come to is like the million others in the county. When these migratory birds have mated, decided where to settle, and have staked off their claim, they proceed at once to construct about the slightest nest that will hold an egg and a bird. "Three sticks and a feather" constitute about the material, according to a recent visitor here. The feather is often wanting, but a few more sticks are generally added. The nest is placed in the crotch of a tree, on two forked branches, or anywhere else in the tree where suitable support can be found. Cedar trees along the river bottoms seem to be preferred, but when the nestings are large, beech and other trees are occupied. From half a dozen to fifty or sixty nests are built in a tree, and only one egg is laid in each nest.

NATURAL HISTORY NOTES.

Interdependence of Plants and Animals.—Few, perhaps, know that a certain little gall fly (*Cynips*) of Asia Minor decides on the existence of tens of thousands of human beings. As our clippers and steamers carry the produce of the land from continent to continent, so these tiny sailors of the air carry the fertilizing pollen from the male to the female flowers of the fig tree. Without pollen there come no figs, and consequently on the activity and number of the gnats depends the productiveness of these trees. The fruit of the fig is not, as in most other cases, a pericarp enveloping the seed, but a common calyx or receptacle which incloses the flowers. In the center of this receptacle the cavity is lined with a multitude of flowers, the male and female blossoms being on distinct plants. The medium of communication to these flowers is only a small aperture at the summit of the receptacle. Hence the access of pollen to the female blossoms is impossible by the ordinary means of transmission, and this is accomplished by the little gnat, which is continually fluttering about from fig to fig for the purpose of finding a suitable place in the cavity to deposit its eggs. These gnats, therefore, regulate in fact the extensive and profitable fig trade of Smyrna. A little ugly beetle of Kamschatka has, in a like manner, more than once saved the entire population of the most barren part of Greenland from apparently unavoidable starvation. It is a great thief in its way, and a most fastidious gourmand moreover. Nothing will satisfy it on a long winter evening—and we must bear in mind that these evenings sometimes last five months without interruption—but a constant supply of lily bulbs. The lilies are well content with this arrangement, for being eaten comes as natural to them as to a Fiji islander; and they are, as a compensation, saved from being crowded to death in a narrow space, while those that escape the beetle shoot up vigorously the next summer in rich pastures. Still better content are the Greenlanders; for, when their last mouthful of meat and their last drop of train oil are gone, they dig up and rob the provident little beetle of its carefully hoarded treasures, and, by its aid, manage to live until another season.

Self Defence among Plants.—Dr. Beccari describes an epiphytal plant, a *myrmecodia*, growing on trees in Borneo. Its seeds germinate, like those of the mistletoe, on the branches of the tree; and the seedling stem, covered by the cotyledons, grows to about an inch in length, remaining in that condition until a certain species of ant bites a hole in the stem, which then produces a morbid gall-like growth, which ultimately becomes a tuber-like body, constituting the home of the ants. Dr. Beccari asserts that the presence of these ants is an essential to the plant's existence, for unless the young plants are thus attacked by these insects they soon perish. The ants then protect their plant home by rushing fiercely out on the intruders. The white sessile flowers in this species are produced on the tuber-shaped body of the plant.

Dispersion of Seeds.—Says Professor Prentl, in a recent lecture on the means taken by plants to disperse their seeds: "Seeds that have not learned to fly with their own or other people's wings, are taught, it seems, to swim. Trees and bushes which bear nuts love low grounds and river banks. Why? Because their fruit is shaped like a small boat, and the rivulets playing over silvery sands, as well as the broad waves of the Pacific, carry their seed alike safely and swiftly to new homes. Rivers float down the fruits of mountain regions, into deep valleys and to far off coasts, and the Gulf Stream of our own Atlantic carries annually the rich products of the torrid zone of America to the distant shores of Iceland and Norway. Seeds of plants growing in Jamaica and Cuba have been gathered in the quiet coves of the Hebrides. The fruit of the red bay has the form of a piroque; at first it sinks to the bottom, but nature has given it a small hole in the upper part; a little air bubble forms there, and causes it to rise again. The gigantic sea cocoa itself, weighing not rarely more than five pounds, but air-tight in its close shell, and buoyant by reason of its light, fibrous coat, is thus drifted from island to island, and rides safely on the surges of the ocean from the Seychelles to the distant coast of Malabar. There it lodges and germinates in the light moist sand, so that the Indians of old fancied that these fruits grew under water, and called them "sea cocoas." A still more striking provision of nature is this, that there are some seeds of this kind so exquisitely adjusted to their future destination, as to sink in salt water, while they swim with safety in fresh water."

The Pedigree of the Dog.

While considering the problem of the origin of the dog, in a recent lecture at the Royal Institute, in London, Prof. Huxley expressed the opinion that its solution was easy if a beginning was made upon a solid basis of fact. Such a basis of fact was supplied by what was known of the origin of dogs in North America. The Indians of the northwestern parts of America were all in possession of half-tame cur-like dogs, living in the same way as the dogs in Egypt—in a semi-independent condition. In the same country there existed a wild animal—the *Canis latrans*, or prairie wolf. It was impossible to point out any distinction between these prairie wolves and the domesticated dog of the Indians. It was somewhat difficult to understand how these wild and fierce animals could be tamed; and yet, when one knew their habits, it was easy enough. The smaller wolves and jackals, although predacious and fierce, were endowed with singular curiosity; that curiosity directed them toward man and his doings. There was not one of these animals which, if caught young—whether jackal or small wolf—could not be tamed and made as attached and devoted to man as any ordinary dog. It was not difficult to understand, therefore, how these animals became acquainted with man, how they became trained, and how from them sprang a race of domesticated animals which, curiously enough, were far more attached to their masters and the animals with which they were brought up than to members of their own family. If they could depend upon the fact that this one domestic dog originated in the taming of an indigenous wild animal, then the general problem of the origin of domestic dogs would take this form—could they find in all parts of the world in which domestic dogs were known wild stock so similar to the existing race of dogs that there was nothing unnatural in supposing that they had the same origin as the Indian dogs? They might trace dog-like animals further and further west, until, in Northern Africa, they had a whole series of kinds of dog-like animals, usually known as jackals. He believed that these wild stocks were the source from which, in each case, the savages who originally began to tame dogs had derived the stock. This view was confirmed by archæological researches. They had preserved to them, on the monuments of ancient Egypt, a great variety of forms of dogs, and it was significant that the further back they went the fewer were the varieties, until, at the time of the third and fourth dynasties—that is about 6,000 years ago—there were only two well marked forms of dogs. One of them was a comparatively small cur-like dog, similar to that which was to be seen in the streets of Cairo at the present day, and the other was like a greyhound. The cur was, no doubt, a tame species of the wild jackal, which was still to be found in the same country; and with respect to the greyhound, there was in Abyssinia a very long-headed dog, which was very much of the same form as the greyhound, and which, it could hardly be doubted, was the source from which it sprang. Assuming that there was no doubt that the origin of dogs could be traced to these sources, the more modified forms of the domestic animal were simply the result of the selected breeding, which had given rise to the same modification in dogs as it had done in the case of pigeons.

Apple Borer.

A subscriber asks how he can get rid of the apple borer. According to a writer on horticultural and agricultural subjects, when borers have once gained possession of a tree the only way to get rid of them is to hunt for them carefully with a knife or wire and destroy them. The eggs of the parent beetle are deposited during nights in June, and are placed in the bark of the tree at the surface of the ground, or whatever may surround the tree. These eggs hatch in our latitude during September; and it is soon after this that the young grub may be easily removed without the use of anything more than the point of a penknife. A few minutes spent in this way about the first of October each fall will keep the tree from this pest.

RECENT DECISIONS RELATING TO PATENTS, COPYRIGHTS, ETC.

Supreme Court of the United States.

BAKER *vs.* SELDEN.

(*Decided October Term*, 1879.)

1. The copyright of a book, if not pirated from other works, will be valid without regard to the novelty of the subject matter.

2. The description of an art in a book entitled to the benefit of copyright lays no foundation for an exclusive claim to the art itself. The description alone can be protected by copyright. The art can only be secured, if it can be secured at all, by letters patent.

3. A work on the subject of book-keeping, explanatory either of old systems or of an entirely new system, considered as a book conveying information on the subject and containing detailed explanations of the art, is the subject of copyright; but the use of the peculiar systems of book-keeping described cannot be protected thereby.

4. Blank account books with ruled lines and headings are not the subject of copyright, nor can the copyright of a work on book-keeping with portions illustrated by such ruled lines and headings secure the exclusive right to make, sell, and use account books prepared upon the plan set forth in such book.

5. Although the proofs show that the defendant makes account books arranged on substantially the same system as that explained in the copyrighted book of the plaintiff, it does not appear that he has violated the copyright of the same regarded merely as an explanatory work, and, as the plaintiff is not entitled to an exclusive right in the system, the charge of infringement is not sustained.

Appeal from the Circuit Court of the United States for the Southern District of Ohio.

Mr. Justice Bradley delivered the opinion of the Court.

Among other things stated is the following:

The remarks of Mr. Justice Thompson in the Circuit Court in the case of Clayton *vs.* Stone & Hall (2 Paine's Rep. 392), in which copyright was claimed in a daily price-current, are apposite and instructive. He says:

In determining the true construction to be given to the act of Congress it is proper to look at the Constitution of the United States to aid us in ascertaining the nature of the property intended to be protected. "Congress shall have power to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their writings and discoveries." The act in question was passed in execution of the power here given, and the object, therefore, was the promotion of science; and it would certainly be a pretty extraordinary view of the sciences to consider a daily or weekly publication of the state of the market as falling within any class of them. They are of a more fixed, permanent, and durable character. The term "science" cannot, with any propriety, be applied to a work of so fluctuating and fugitive a form as that of a newspaper or price-current, the subject matter of which is daily changing and is of mere temporary use. Although great praise may be due to the plaintiffs for their industry and enterprise in publishing this paper, yet the law does not contemplate their being rewarded in this way; it must seek patronage and protection from its utility to the public, and not as a work of science. The title of the act of Congress is "for the encouragement of learning," and was not intended for the encouragement of mere industry unconnected with learning and the sciences. . . . We are accordingly of opinion that the paper in question is not a book the copyright to which can be secured under the act of Congress.

The case of Cobbett *vs.* Woodward (L. R., 14 Equity Cases, 407) was a claim to copyright in a catalogue of furniture which the publisher had on sale in his establishment, illustrated with many drawings of furniture and decorations. The defendants, being dealers in the same business, published a similar book, and copied many of the plaintiff's drawings, though it was shown that they had for sale the articles represented thereby. The court held that these drawings were not subjects of copyright. Lord Romilly, M. R., said:

This is a mere advertisement for the sale of particular articles which any one might imitate, and any one might advertise for sale. If a man, not being a vendor of any of the articles in question, were to publish a work for the purpose of informing the public of what was the most convenient species of articles for household furniture, or the most graceful species of decorations for articles of home furniture, what they ought to cost, and where they might be bought, and were to illustrate his work with designs of each article he described—such a work as this could not be pirated with impunity, and the attempt to do so would be stopped by the injunction of the Court of Chancery; yet, if it were done with no such object, but solely for the purpose of advertising particular articles for sale, and promoting the private trade of the publisher by the sale of articles which any other person might sell as well as the first advertiser, and if in fact it contained little more than an illustrated inventory of the contents of a warehouse, I know of no law which, while it would not prevent the second advertiser from selling the same articles, would prevent him from using the same advertisement, provided he did not in such advertisement by any device suggest that he was selling the works and designs of the first advertiser.

Another case, that of Page *vs.* Wisden (20 *Law Times* Rep., N. S., 435), which came before Vice-Chancellor Malins

in 1860, has some resemblance to the present. There a copyright was claimed in a cricket scoring sheet, and the Vice-Chancellor held that it was not a fit subject for copyright, partly because it was not new, but also because "to say that a particular mode of ruling a book constituted an object for a copyright is absurd."

The decree of the Circuit Court must be reversed, and the cause remanded, with instructions to dismiss the complainant's bill.

WOODBURY PATENT PLANING MACHINE COMPANY *vs.* KEITH.

(*Decided October Term*, 1879.)

1. Woodbury filed a caveat May 28, 1846, and his application June 3, 1848. The latter was rejected February 20, 1849, and the fee withdrawn in October, 1852. Under the act of 1870 the application was renewed within the six months allowed, and the patent granted April 29, 1873. No serious attempt having been made to procure a re-examination of the old application, or to renew it, for a period of more than twenty years, though during more than sixteen years of that time the improved device had been in common use with the knowledge of the patentee, it was held that the invention was abandoned before the renewed application was made.

2. The action of the Commissioner of Patents in granting a patent, under section 35 of the act of 1870, is not conclusive on the question of abandonment.

3. The rule of the Patent Office prior to the passage of the act of 1870, that an application rejected, or not prosecuted within two years after its rejection or withdrawal, should be conclusively presumed to have been abandoned, though not always adhered to, had held it to be a question of law in the cases to which it applied, and the effect of the statute was rather to change the rule than to make the decision of the Commissioner granting a patent an unreviewable decision that the invention had not been abandoned.

4. Section 35 of the act of 1870 declares abandonment to be a question of fact, and patents granted thereunder are just as impeachable as those granted under section 24, whereby the Commissioner is authorized to deal with the question of abandonment as well as public use and sale and originality of invention.

5. Abandonment, although a matter of intention on the part of the inventor, need not be expressed in words, but may be gathered from the acts of the inventor.

6. Abandonment may occur as well after an application has been made and rejected or withdrawn as before, and evidenced in the same manner.

7. The law requires and favors diligence in prosecuting the claims to an exclusive right, and an inventor cannot, *without cause*, hold his application pending during a long period of years, leaving the public uncertain whether he intends ever to prosecute it, and keeping the field of his invention closed against other inventors.

8. Circumstances may arise which will excuse delay in prosecuting an application, such as extreme poverty or protracted sickness; but in the absence of any such excuse entire inaction on the part of the inventor, coupled with long-continued public use without complaint or remonstrance on his part, constitute abandonment to the public.

9. The rule of the Patent Office that an application rejected, or not prosecuted within two years after its rejection or withdrawal, should be conclusively presumed to have been abandoned, was not a statutory rule, nor inflexible in its application, but was frequently departed from and abolished before the act of 1870, and was no bar to a movement on the applicant's part to have his application reinstated after withdrawal, or to have it re-examined, or take an appeal, or file a new one, and cannot be regarded as an adequate excuse for a long delay.

10. Woodbury's invention, patented April 29, 1873, was anticipated by the machine made by Alfred Anson in 1843, and in constant use for thirty years.

11. Mere enlargement of a machine to strengthen or increase its capacity is the work of the mechanic and not invention.

12. An objection to the examination of a witness should state specifically the grounds of the objection, in order that the opposite party may have the opportunity of removing it, if possible.

13. Under section 4920 of the Revised Statutes only the names and residences of those who had invented or used the anticipating machine or improvement, and not the names of those who are to testify of its invention or use, are required to be pleaded.

Bill dismissed with costs.

The Sense of Space.

At a recent meeting of the French Society of Biology M. Mathias Duval reported what he believed to be an important discovery in relation to the origin of the auditory nerve. He finds, in the course of his researches upon the origin of the cranial nerves, that the auditory nerve has two quite distinct roots, the posterior one proceeding from a nucleus, described by all authors, the other, anterior, proceeding from a nucleus for motor fibers. Some fibers of the anterior root turn back into the cerebellum. Now, we know that the cerebellum is the center for the co-ordination of movements. In associating this anatomical fact with the physiological researches of M. De Cyon, upon the sense of space, and with some pathological facts, tending to prove that vertigo has for a cause a lesion of the semicircular canals, M. Duval concludes that the anterior root of the auditory nerve forms the *nerve of space*, of which the semicircular canals are the peripheric organs.

Minneapolis Flouring Mills.

The pride of Minneapolis, and one of the principal factors in the wonderful growth and prosperity of our city, are the unrivaled and matchless flouring mills which line the bank of the Mississippi River at the Falls of St. Anthony, and whose unequaled products have already given to Minneapolis flour a world-wide reputation. Twenty-four of these splendid mills, which stand as monuments of Minneapolis courage and enterprise, have already been erected, and others, still more extensive and imposing, are to follow at an early day. Among the most prominent of those already constructed are the great Washburn A and B, and the Crown Roller mills. The Washburn "A," standing on the site of the one destroyed by the explosion of May 2, 1878, is 100x244 feet, is nine stories high, and will, by the adoption of newly invented machinery, have a capacity of 3,000 barrels daily. The Crown Roller Mill, now nearly completed, has a ground surface of 124x144 feet, is eight stories high, and, using the most improved styles of machinery, will be able to turn out 2,500 barrels daily. Both of them are to be illuminated with the newly invented electric lights, and are, in all respects, the largest and most complete flouring mills in the world. The highest grades of flour are made at these 24 mills, which is eagerly sought for in the markets of the world. The entire daily products of these mills, when fully completed and running, will reach the enormous amount of 17,500 barrels every 24 hours, and requiring, if the mills be run 300 days in the year, not less than 25,000,000 bushels of wheat for their use alone, or far more than one-half the entire present wheat production of the State.

The effect of this constant demand upon the crop of our State is already well understood by all intelligent business men and farmers, steadily maintaining as it does the price of wheat from 5 to 10 cents per bushel above what it would be if left to be governed alone by the Milwaukee, Chicago, and Eastern markets. The average price received by the farmers of Minnesota for their wheat during the years '77, '78, and '79, by reason of the local market of Minneapolis, is not less than 7 cents per bushel on the crops named more than they would have received if left to the control of the Milwaukee and Chicago markets, or in the aggregate not less than $7,000,000 has actually been added to the pockets of the wheat growers of our State by the existence and operations of the Minneapolis millers. This vast sum of money has not only been received by the farmers to add to their comforts and conveniences of life, but has gone through their hands to swell the great volume of trade which has built up our towns and commercial centers. This fact alone, now so well understood by the wheat growers of Minnesota, is a complete and conclusive answer to charges of political knaves and demagogues who occasionally seek, during election campaigns, to represent the Minneapolis millers as the natural enemy and scourge of the wheat-growers of our State. The growth and development of the milling interests of Minneapolis are strikingly shown by the following list of shipments for the years named:

Year	Barrels
1860	30,000
1865	95,000
1870	193,814
1873	565,118
1874	797,157
1875	848,760
1876	1,000,676
1877	985,544
1878	940,678
1879, estimated in part	1,500,000

In explanation of the diminished shipments in 1877 and 1878, we would state that in 1877 there was an almost entire failure of the wheat crop in a large territory from which the mills drew their supplies; and in May, 1878, over two-fifths of the milling capacity was destroyed by fire, and in November another twelve-run mill shared the same fate.

Before dismissing this subject it may be of interest to the general reader to know that, in Minneapolis, the so-called "patent process," by which the highest grade of flour is produced, was first developed, and to show its advantage to the State at large, it is only needful to add that before the new process was developed, spring wheat—the only kind successfully cultivated here—sold for an average of twenty-five cents a bushel below the price of winter wheat. To-day, by the "patent process," the price of spring wheat, such as our farmers raise, is worth more than winter wheat, for the reason that the "patent process" can be applied only to this kind of wheat, and the product leads the price in the flour markets of the country.

The future of this great interest of our young city it is hardly possible to imagine. As yet it is but in its infancy, and already has its firm grasp upon the markets of the world. How rapidly it is extending itself will be seen by the following facts:

In 1875 Mr. George H. Christian went abroad with the view of studying foreign milling processes, and introducing, if possible, Minneapolis flour upon the European market. Mr. Christian learned much of foreign milling, but met little success as to the other part of his mission. For two years following, the quality of our wheat was such as to render it difficult to keep the grade of our flour up to a satisfactory standard, and no effort was made to cultivate a foreign market. In the spring of 1877, Mr. L. Christian went abroad to follow still further the previous investigations of his brother G. H., and to study more closely the flour trade of the leading cities of the Old World, and on his return Mr. W. H. Dunwoody went out to still further study the question of direct trade between the Minneapolis manufacturers and the leading flour houses in England and Scotland. The result of these various missions was that foreign dealers became better informed as to the character of our flour and the advantages of introducing it to their customers, and in 1878 a small direct export trade confined mainly to "bakers'" and low grades was established. Later on, small samples of the "fancy" were ordered for Liverpool, London, and Glasgow, and the trade once inaugurated increased rapidly until it had thus early grown into considerable magnitude, and not less than 450,000 barrels, or their equivalent in sacks, have been shipped during 1879 direct from the mills in Minneapolis to leading points in the United Kingdom, France, Germany, Spain, and Italy, while direct shipments have also been made to Alexandria, Egypt. To-day there is not a port in Europe to which through bills of lading cannot be obtained in Minneapolis at fixed rates.

English millers and dealers who have visited our great mills during 1879 have frankly stated that in their opinion the fine grades of Minneapolis spring wheat flour are destined to supplant the products of the Hungarian mills which have controlled the English market for so many years. The trade thus sought to be established amounted in 1878 to but $763,281, but in 1879 had increased to $3,150,000. What that trade will amount to in the future can be predicted only from its wonderful triumphs in the past.—*Pioneer Press.*

The Paris Abattoir.

The slaughter houses of Paris are located at La Villette, on the outskirts of the city, and form, together with a police station, telegraph office, barracks for a small force of troops stationed there, and other buildings, a town of very respectable size. The buildings, which are of stone, were constructed in the most thorough manner by the city under government authority. The premises are inclosed by a high stone wall, and the grounds are divided into regular rectangles by four avenues, intersected by four streets.

Through each building runs a series of cours, covered with a glass ceiling, and in these cours the slaughtering is done, the animals being dressed on wooden frames placed at regular intervals on each side of the cour. A peculiar feature of the business is that of blowing up the carcass as soon as the head and legs are cut off, which the *Commercial Bulletin* describes as follows: The body being placed on the dressing frame, an incision is made in the breast near the neck, and the nozzle of a bellows inserted. A man then works the bellows for about fifteen minutes, until the whole carcass is swollen out like a small balloon. The reasons given for this are that it makes the meat look better, more plump than it otherwise would, and that it enables the one who skins the carcass to get the hide off quicker and easier, without injuring it. All bullocks, calves, sheep, etc., slaughtered in these establishments are blown up in this manner.

Pig butchery in Paris is also conducted upon a novel plan. The pigs are taken into a large round house, having a cupola in the roof to let off the smoke, the floor being divided into triangular dens. A dozen or so of pigs are driven into each den at a time, and a butcher passes along and strikes each one on the head with a mallet.

After being bled, the defunct porkers are carried to the side of the room and arranged methodically in a row. They are then covered with straw, which is set on fire and the short bristles quickly burned off. After a thorough scorching the pigs are carried into the dressing room, hung up on hooks, and scraped by means of a sort of drawing knife, handled by a skillful operator, who performs his work at the rate of about one pig a minute. Then the bodies are washed and the entrails taken out and cleaned.

Every part of the animal is utilized in Paris, and that which the American throws away as worthless is made to subserve some use in the Frenchman's economy. The pig's blood is used in the manufacture of the large black sausages which meet with such extensive sale in Paris. The long bristles are pulled out by hand and go to the brush maker.

Regenerating the Potato.

The well known writer, Mayne Reid, has been experimenting with Mexican seed potatoes in Herefordshire, England, thereby doubling his crop and entirely escaping the blight which has been so fatal to the English and Irish potato crop of late years. He says, in a letter to the London *Live Stock Journal*, that for the last three years he has been cultivating seed which came direct from Mexico, with the result, that while ten other sorts, planted in the same field, tended with like care—in short, *ceteris paribus*—have all been more or less diseased, his Mexican "papas" show not a spot of blight. Nor is this all in their favor, for while the best of the other kinds have yielded less than five tons to the acre, they have produced over ten, in common drills done by the plow. Hundreds of specimens were above one pound in weight, some even a pound and a half.

After being stored in ordinary field pits through the winter the Mexican potatoes come out perfectly sound, and seem to improve in quality as the spring advances. As an article for the table he thinks they have no superior; and he proposes that his government take in hand the importation of Mexican and Peruvian seed as a cure for the potato blight.

Bonesilate.

A new material, called bonesilate, has been added to the manufactured products of Newark, N. J. Its basis is bone dust. It can be polished and colored, and is harder than celluloid. It is used for buttons, door knobs, billiard balls, and other articles now made of ivory and hard rubber.

NEW INVENTIONS.

A machine for giving to railway and other spikes a uniform twist from the head to the point has been patented by Silas H. Wilson, of Auburn, N. Y. The invention comprehends an improved combination of rotary jaws, reciprocating die wheels, and feeding mechanism. It consists also of grooved rollers journaled in a carriage which is adapted to move toward and from the rotary jaws, which receive the spike, carry it to the jaws, and hold it against rotating while the jaws are twisting it, the lower grooved roll having also a vertical movement to allow the spike to pass between it and the upper roll, and to enable it to release the spike after the twist is put in it.

Mr. George W. Dudley, of Waynesborough, Va., has patented a novel saw filing and setting machine designed especially for saws having a straight row of teeth, and it comprises features of improvement as follows: A peculiar construction and arrangement of devices for imparting an elastic cutting stroke to the file; means for raising the file on the back stroke; a peculiar construction of guide for holding outer end of file frame against lateral displacement and determining the depth of cut; means for shifting angular position of saw to give alternate incline to the edge of teeth; clamping and holding devices for the saw; means for adjusting the saw to an angular or straight position; means for locking and holding the saw in position; a peculiar construction and arrangement of the saw-set; also a double adjustment of the wrist pin connecting with the file-driving pitman to adapt the device to longer or shorter files.

Mr. Charles H. Horton, of Brighton, O., has patented an improved apparatus for automatically weighing or measuring grain and registering the operation. The grain is received in a rocking box or receiver having two compartments that are alternately filled and emptied, the weight of the grain acting to shift the box as required. The box is hung on a scale beam having an adjustable weight, whereby the quantity discharged at each alternation is regulated, and the movement of the receiver gives motion to registering mechanism, so that the oscillations are recorded.

Mr. Stephen S. Wood, of New York city, has patented improvements in sand distributers for horse-cars to apply sand to the rails to prevent the wheels from sliding when the brakes are applied. The invention consists in the combination, with the frame-work of a car and with hoppers attached to the frame-work, of a mechanism by which sand may be discharged upon the rails.

Mr. Andrew T. Jackson, of Cotton's Store, Ala., has patented an improved chimney flue and shield, designed to prevent leakage around stove-pipes when they pass directly through the roof of a building and to avoid the use of horizontal lengths in such pipes. The invention consists in a conical shield and pipe secured upon a plate that is fixed to the roof, and combined with a weather cap and the stove pipe in a manner to exclude rain from the inner side of the roof, and to obtain other advantages.

An adjustable pattern for cutting out boot and shoe soles of any dimensions has been patented by Messrs. John P. Simon and Jacob Lex, of Hartford, Wis. It consists of a metal plate of the general shape of the sole and provided on its upper face with short studs, upon which studs are fitted slotted metal plates shaped to conform, respectively, with the outlines of the sides, heel, and toe of the sole, the adjustable plates being also held together by slots and studs, so that they may be moved in or out to contract or expand said pattern in proper proportion in every direction.

Mr. Mark A. Dees, of Scranton, Miss., has patented an adjustable frame adapted to support a lamp and brush in combination with the treadle, rods, and operating levers.

Mr. John J. Gordon, of Flint, Mich., has patented an improvement in butt-hinges, designed to facilitate the fitting of the hinge in place; and it consists in constructing the hinge with leaves of different widths and forming on the narrower leaf a flange, by which construction the shape and depth of the mortise into which the hinge is fitted may be laid off and the use of the square dispensed with.

A series of mirrors have been supported upon one or more standards and grouped or arranged in such a manner that a figure seen in one of them would be seen in all the others. Mr. Joseph P. Short, of Dodgeville, Wis., has patented an invention which is an improvement in this line. It consists in the combination and arrangement of four mirrors, suitably secured in a frame, so that front and back views of the same figure will appear in opposite mirrors.

An improved railway car for transporting live stock, more especially horned cattle, has been patented by Mr. William Martin, of San Francisco, Cal. The improvement relates to swinging stanchions or guards for securing the cattle.

An improvement in hydraulic ram motors has been patented by Mr. James Thomas, of Catasauqua, Pa. The object of this invention is to furnish hydraulic rams so constructed that they may be used to deliver power. The invention consists in the combination of a secondary piston and cylinder with the water chamber of the ram.

Mr. Anton Zimmerer, of Nebraska City, Neb., has patented an improvement in that class of knives that are designed for cutting hay, straw, fodder, etc., in bundles or stacks. The invention consists of a series of revolving or stationary circular cutters inserted along the cutting edge of a suitable blade, bar, or frame.

A novel steam generator for heating and dampening wheat in flour mills, for steaming feed for farm purposes, etc., has been patented by Mr. Oscar Van Tassell, of Parkersburg, Iowa.

Mr. Henry Hickman, of Omaha, Neb., has patented a collar button that will hold the necktie and prevent it from slipping. The invention consists of a collar button provided with one or more points at the end of the shank, which pass into the necktie and hold it in place. It also consists in providing the shank with an adjustable screw head, which can be set to cover the points so that they do not catch in the clothing.

An improved hat press has been patented by Mr. M. A. Cuming, of New York city. The object of this invention is to improve the construction of the hat presses for which letters patent Nos. 167,506, and 178,740 were granted to the same inventor September 7, 1875, and June 13, 1876, respectively, the object being to make them more satisfactory in use and more effective in operation.

Mr. Tristram W. Blades, of Point Pleasant, W. Va., has patented an improvement in guide boards or indicators, which consist in a certain construction and arrangement of parts, which cannot be clearly described without an engraving.

Mr. Jacob Huy, of Whistler, Ala., has patented an improvement in the class of cars for transporting live stock which have a second floor or deck, that is vertically adjustable, and racks and troughs suitably arranged for supplying food and water to the animals on one or both floors. Four different kinds of animals can be loaded in this car, and each kind or lot may be kept separate from the rest, and each can be fed separately and conveniently with the food suitable to its taste and requirements. After the animals have been unloaded the car can be quickly made ready to be loaded for a return trip. To do this the deck or false floor is raised and secured beneath the roof of the car.

Mr. Charles E. Glazier, of Hornellsville, N. Y., has patented an improved spray nozzle for hose and other water pipes, which consists in a certain novel construction and arrangement of devices for breaking up the stream of water and converting it to spray without back pressure on the column.

An improvement in India-rubber and other gum compounds for surfacing cloth and for other purposes has been patented by Mr. Charles Y. Beach, of Fairfield, Conn. This invention has for its object to overcome the objectionable odor commonly present in goods that are made wholly or partly of rubber or other gum compounds. The invention relates to the preparation of the gum compounds for general use in the arts; but the principal application of the discovery is in surfacing cloth and other fabrics with rubber or other gum compounds.

An improved tether has been patented by Mr. Eugene H. Angell, of Mooers, N. Y. The object of this invention is to furnish combined tethers and tackles, so constructed that when arranged as a tether the slack of the rope will be taken up to prevent the animal from becoming entangled in it, which will prevent the tethered animals from being injured by a sudden pull or jerk upon the rope, and which will allow the tackle to be detached from the tether and used as an ordinary tackle.

Mr. Fortunato C. Zanetti, of Bryan, Texas, has patented an improved game apparatus. The invention consists in a series of tilting levers arranged at the end of an alley and hinged to a rod resting on two standards connected by check-rods, against which the ends of the tilting levers rest in their several positions. The tilting levers are provided with numbered plates and with bells, which ring when a lever has been struck by a ball and tilts.

Mr. Henry Lefort, of Newark, N. J., has patented a new and improved watch crown, which can be easily held and adjusted in the pendant and is simple in construction. It consists in a spring bushing loosely mounted on a flanged sleeve adjustable on the pin of a watch crown, whereby the crown is held in the pendant by the pressure of the spring bushing against the sides of the pendant.

Mr. Gustav F. Sievern, of Brooklyn, N. Y., has patented an improvement in holders for window clothes-lines so constructed that the clothes may be placed upon and removed from the lines without its being necessary for the operators to lean out of the window.

Mr. William C. Culbertson, of Girard, Pa., has patented an improved iron fence post, so constructed that it may be easily set up, taken down, and removed from place to place. It is strong, firm, and durable.

Mr. Laning L. Ferris, of New York city, has patented an improved bill and letter file which will permit inspection or removal of the papers upon it and may be used for binding the papers together. The invention consists of a plate secured by a set screw to a suitable base and carrying two fixed and two removable arms or wires which curve inward, the point of the fixed wires overlapping the points of the removable wires, so that the bills may be inserted between the points and pressed upon either pair of wires. The removable wires are eye-pointed to receive a cord, and may be drawn down through the plate when the latter is removed from its support.

Mr. John Copcutt, of Yonkers, N. Y., has patented an improvement in the construction of the floors, doors, and shutters of buildings. The object of the invention is to prevent the rapid spreading of fire from one part of a burning building to another by burning through those parts.

A felting machine with an adjustable and self-adjusting apron surrounding the felting roll, whereby the machine may readily adapt itself to the bat and the more delicate operations of felting may be performed, has been patented by Mr. John G. Meeker, of Danbury, Conn.

Mr. Norman Allen, of Rockaway Beach, N. Y., has patented a fan containing a number of leaves or sheets adapted to receive advertisements. It is composed of a middle thick sheet of paper, to give stiffness to the fan, and several thinner sheets joined together and provided with a suitable handle.

The Eruption of Colima.

The volcano of Colima, near the Pacific coast, directly west of the City of Mexico, was in active eruption in the forepart of May. The first symptoms of activity were manifested on the first. A dispatch from Mexico, dated May 5, says: The eruption at night is full of splendor and grandeur. Last night lurid flames shot up from the crater of the volcano, illuminating the darkness for miles around. Incandescent stones are also thrown up, together with showers of ashes, which darken the atmosphere in daytime. The fire, smoke, ashes, and stones are accompanied with dreadful subterranean thunderings and frightful and unearthly noises under the volcano, together with quakings of the earth. Inhabitants of villages and towns in the vicinity of the mountain are in a state of panic and wild terror. They are, indeed, in danger in case of a flow of lava.

Colima is 12,000 feet high, and forms the southwestern extremity of a mountain chain traversing Mexico from east to west. Previous to 1869 it was supposed to be extinct.

Studying Puzzles a Waste of Time.

The *Educational Monthly* reflects the sentiments of most thoughtful persons in the following paragraph:

There seems to be, says the writer, a fascination about arithmetical puzzles that leads many persons to waste their time and tire their brains in efforts to solve them. The "13 15 14" puzzle that is now going the rounds is a type of the entire class of puzzles, for it has the following characteristics: 1. The solution can only be found by a tentative process of trial and experiment, and the only tincture of mathematical science which it has is its value as an example in the mathematical doctrine of probabilities. 2. The solution, when it is obtained, does no good, and is utterly devoid of value. It is said that some one gave this puzzle to the great engineer De Lesseps while he was examining the Brooklyn bridge. Great engineers, however, are as likely to fail as other people, and great mathematicians like Isaac Newton and Sir William Rowan Hamilton have no advantage over school boys. If the time spent in deciphering such puzzles were devoted to the study of useful problems, there would be a surprising increase in the sum total of arithmetical knowledge.

Commemorative Medals for Paris Exhibitors.

A dispatch from Paris, dated May 7, announces that the Commission of the Universal Exhibition of 1878 has ordered the striking of 6,800 commemorative medals to be distributed among the members of the foreign commissions, juries, and exhibitors who did not compete for prizes. The medals will be of bronze and will involve an outlay of 300,000 francs. A similar medal will be struck for distribution among the foreign as well as the French journalists who were provided with season tickets to the Exhibition. There still remain 7 gold, 101 silver, and 526 bronze medals, and 2,510 honorable mentions, to be distributed among exhibitors who have not yet asked for them.

To Keep Grain Cargoes from Shifting.

Considerable interest has been manifested in New Orleans with regard to a device patented by a firm in that city to prevent the shifting of grain or any other treacherous cargo. It consists in dividing the ship into longitudinal compartments, secured by rods from side to side of the vessel. These compartments are to be divided longitudinally by sections into any required space that may be desired, in order to effectually separate different kinds of grain, etc., without the use of bagging. The plan is thought to be cheap, simple, and effective.

The Telephone in Paris.

The Edison telephone is in full operation in Paris, the exchange there numbering over 350 subscribers. The carbon transmitter and Phelps receiver are employed. The lines are under the management of the state, and a closed circuit is employed in order to avoid induction currents. Experiments up to distances of 140 miles have been made with success. Trial of the telephone is also being made at the Carberry Mine, near Inveresk, in Scotland.

Prizes for Boys.

The Maine experiment of offering rewards to boys for successful farm work is to be imitated in Vermont. Two of the trustees of the State University have offered $150 in prizes to boys not over seventeen years of age for the best crops of potatoes and corn on one eighth of an acre. The practice is a good one, and might be wisely adopted with benefit to our agricultural interests as well as to boys.

THE PENNSYLVANIA RAILWAY CO.'S ELEVATOR.—The new grain elevator of the Pennsylvania Railroad at Jersey City is rapidly nearing completion. It is 300 feet long, 145 feet wide, and will have a capacity of 1,500,000 bushels. Four "conveyers" will run from the building to the wharf for unloading canal boats and loading ships; and the building will have twenty-four sets of elevating apparatus for taking grain from cars.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

We will purchase or manufacture on royalty, Stationers' Articles of real merit. A. C. Farley & Co., Phila., Pa.

Analytical Balance wanted; second-hand. W. G., Kirks Mills, Pa.

Wanted—To Manufacture Small Patented Iron Articles. Address Iron Works, New Castle, Ind.

Superintendent wanted, skilled in the use of fine wood working machinery. Large wages to the right man. Address Phœnix, Herald Office, New York.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

For Sale.—4½ inch refr. Telescope, Prism, 4 eyepieces and tripod. Price, $160. H. M. Holbrook, Jersey City, N.J.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Horton Car Wheel Chucks.

Geared Power Press, cost $450, for $200. York & S., Clev. O.

Wilson's Business Directory, second edition, and Wilson's Co-partnership Directory for 1880-81, now ready. All orders addressed to the Trow City Directory Company, No. 11 University Place, New York, promptly attended to, on receipt of price, $5 each.

LAKE VIEW HOUSE, LIVONIA, N. Y., Feb. 9, 1880.
H. W. Johns M'f'g Co., 87 Maiden Lane, New York.
DEAR SIR: We have used your paint on our buildings, and find one coat goes as far and covers as well as two coats of lead and oil. Yours truly,
S. B. BOLLES.

Machinery Salesman Wanted—One who thoroughly understands and can sell Iron and Wood Working Tools. Address T. S. & A. J. Kirkwood, Chicago, Ill.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Blake's Belt Studs are the best and cheapest fastening for leather and rubber belts. Greene, Tweed & Co., 118 Chambers St., New York.

Wanted—A Machinist. One who has wrought at Carriage Hardware Manufacturing, and is fully able to construct the dies and tools necessary for such goods. Address, with references, George Gillies, Gananoque, Ontario, Canada.

For the Development of New Ideas, try Anderson Bros., Peekskill, N. Y. Experience large.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, & Hand Presses for Metal Workers. Moderate prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Steel Figures, $1; Letters, $3 a set. York & S., Clev., O.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Walrus Leather and Walrus Wheels for Polishing all kinds of Metals. Greene, Tweed & Co., New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 334.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 300.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 49 and 50 Astor House, New York.

Blake "Lion and Eagle" Imp'd Crusher. See p. 301.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 301.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 317.

Peck's Patent Drop Press. See adv., page 316.

Forsaith & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 316.

For Separators, Farm & Vertical Engines, see adv. p. 316.

For Patent Shapers and Planers, see ills. adv. p. 316.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 317.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Solomon's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Silent Injector, Blower, and Exhauster. See adv. p. 333.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 333.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 332.

The "Fitchburg" Automatic Cut-off Horizontal Engines. The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass.

Millstone Dressing Machine. See adv., page 334.

Steam Engines, Boilers, Portable Railroads, Sugar Mills. Atlantic Steam Engine Works, Brooklyn, N. Y.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

For Alcott's Improved Turbine, see adv. p. 334.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 732 Broadway, N. Y.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

Improved Work Holder for Lathes, Gear Cutting, Attachments for Lathes, Tyson Vase Engine, Small Steam Motor. No boiler, no danger. Send for new catalogue, 1880. Jackson & Tyler, Baltimore.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 301.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

New Economizer Portable Engine. See illus. adv. p. 333.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Lathes, Planers, and Drills, with modern improvements. The Pratt & Whitney Co., Hartford, Conn.

NEW BOOKS AND PUBLICATIONS.

THE MAGAZINE OF ART. Cassell, Petter, Galpin & Co., London and New York. Price 25 cents a number.

A monthly publication containing well executed wood engravings of famous London buildings, bridges, fountains, and street scenes. Every number has illustrations from celebrated paintings, also of remarkable ancient and modern vases. The magazine is well printed and in convenient form for binding.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) Z. C. S. asks for a rule for finding the sectional area of a boiler shell. A. By a table of areas, deduct the area of the diameter of the inside of shell from the area of the diameter of the outside of shell, the remainder is the sectional area of shell. Or multiply the thickness of the plate by the average of the circumference of the outside and inside diameters of shell, the product is the sectional area.

(2) A. P. asks: 1. What is the least pressure required to blow off with, the submersion and diameter of blow off pipe being given? A. Disregarding friction, etc., the pressure should be at least one pound for each two feet head of water above mouth of blow-off pipe. 2. What size must a feed pump be, diameter of cylinder being given? A. The size of feed pump is determined by the quantity of water evaporated and not by the size of cylinder. 3. What size of safety valve does a boiler require (grate surface and steam pressure to be carried being given)? A. The rule of the United States steamboat inspectors is one square inch area of valve to each two square feet of grate surface. 3. What lift must a valve of given diameter have? A. One-fourth the diameter of valve. 5. What is the ratio of expansion of wrought iron? A. For each degree of heat (Fahrenheit) 0.00814 of one inch for each 100 feet length.

(3) H. L. S. asks if it is necessary to have an air pump in connection with an engine that exhausts into a keel condenser, said condenser being under the bottom of the boat and consequently always cold and not liable to get hot, pressure of steam 60 to 100 lb., revolutions 75 to 100. The idea of condensing in this manner is to save the fresh water so as to be used in place of salt. A. It is necessary to have an air pump if you wish the benefit of a vacuum, otherwise you can take the water from the condensing pipes with the feed pump.

(4) E. C. N. writes: I have made a dynamo electric machine about five times the size the one that was in the No. 161 SUPPLEMENT with a double coil in the armature, and use only one pair of brushes for my commutator. My machine works well and generates a great deal of electricity. I connect the circuit on the machine with No. 6 copper wire, and take my electricity from the binding posts of the brushes. When running the machine 800 revolutions per minute the machine will fuse 3 copper wires No. 30, 12 inches long, showing that I have great resistance in my machine. I will say right here that I have for field magnets soft cast iron 22 inches wide, 13 inches high, 2 inches thick, wound with 8 layers of double wire No. 14. The armature has one coil, is wound with 2 wires of No. 16, 7 layers; the other with 5 wires No. 18, 7 layers. My commutator is made different from any that I have seen or heard from. My first coil is put on the inside ring, and the wire soldered and the slot cut for neutral points; the other ring is on the same commutator with one-eighth of an inch apart and the slot cut 90 degrees from the others, slot one thirty-second inch. I have but very little sparks at the commutator. I have made a lamp somewhat after the form of Brush lamp, and use Brush carbons, and have a very large light with very small arc, not more than one-sixty fourth of an inch, but the carbon are incandescence one-half of inch. I have in my lamp on the coil or hollow magnet six layers of No. 14 wire. After running about one hour the coil gets so hot that I cannot handle it, and I have to shut down the machine. What is the trouble? The machine does not get very hot. A. Use coarser wire in your lamp helix. You have succeeded very well with your machine.

(5) T. B. asks: 1. Can I use electro-magnets for the dynamo-electric machine described in SUPPLEMENT No. 161, Fig. 6? A. Yes. 2. And if not, how can I make magnets permanent, and from what kind of iron are they made? A. Permanent magnets are made from steel, hardened and tempered. You will find directions for making permanent magnets in an article on telephones in SUPPLEMENT 142. 3. Can the part surrounding the armature be made of wrought iron pipe, as shown in Fig. 6? A. Yes.

(6) C. S. W. asks: Are there any coal or peat beds in the torrid zone? Where? What is the reason that there are more in the temperate zone than elsewhere? A. No peat. Very little coal of carboniferous period. Tertiary coal, "brown coal," abundant in in South American tropics. A cool moist atmosphere is required to develop peat.

(7) T. C. asks: If a wire be attached to a safe or stove in an office of a hardware store and conveyed to the moist earth beneath, will it be a good protection against lightning? A. No; use a good lightning rod with large ground connections placed in moist earth.

(8) S. S. B. asks: 1. Is it practicable to use three-eighths inch gas pipe for a water grate in an upright boiler having one end connected to pump and the other to the crown sheet? Boiler is 16 inches diameter, 3 feet high, with 19 1¼ flues, 1 foot long. A. You could use them, but they would soon burn out. 2. Is such a boiler large enough to drive a 6 inch by 4 inch engine with 60 lb. steam, and 250 to 300 revolutions per minute? A. It may answer with an exhaust jet, but is rather small without it.

(9) J. F. E. asks (1) how to construct a galvanometer for testing electrical resistances. A. A simple galvanometer may be made by suspending a magnetized cambric needle over a flattened helix of fine wire. For details of construction of delicate instruments of this kind see Prescott's Electricity, or Frick's Physical Technics. 2. Can you give me better detail of the reversing gear of Mr. Maxim's steam launch, SUPPLEMENT No 188? It does not give a clear explanation as to the setting of the eccentric. How far should it be moved to give proper "lead" both ways? Has the loose piece on shaft that works in the drum more than one spiral groove? A. The eccentric will be set in the usual manner, and by throwing it across to the opposite side, it is in position for reverse motion without lead. You must lay out a diagram to get the proper lead and throw for your valve. We do not understand there is any spiral groove, though this would probably be better, as you could then get the proper lead in both directions. 3. What horse power would a 3½x3½ stroke engine give 300 revolutions per minute, with 75 lb. of steam? A. About three-fourths lb. horse power. 4. What size boat can I run with it at the rate of eight miles per hour? Also what size screw and pitch? A. Probably 12 feet long and 3½ to 4 feet beam, screw 14 inches diameter and 2 feet 4 inches pitch. 5. Ports are 30-100 inch area; are they large enough? A. Ports should equal five-tenths inch. 6. What size pump shall I use? A. Half inch diameter of plunger, if it has the stroke of the engine.

(10) W. F. O. asks: Suppose a string fastened at one end will just support a weight of 25 lb. at the other. Unfasten it, and two persons pull upon it in opposite directions. How much can each pull without breaking the string? A. 25 lb. This amount applied to each end brings a total strain of only 25 lb. on the string. Try this experiment with spring scales instead of a string.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

I. P. B.—The incrustation consists chiefly of oxide of iron, lime carbonate, and organic matter. The water is probably unfit to drink. There is no practical way of purifying it.—E. B. S.—It is itacolumite, or flexible sandstone, often found in diamondiferous regions. It has been used for making grinding wheels.—W. H. G.—The slate carries a trace of copper, but probably no silver. A fire assay of a larger sample would be requisite to settle this point.—W. B.—It is a glass colored by oxide of cobalt—cobalt glass.

COMMUNICATIONS RECEIVED.

On Solar and Planetary Force and Attraction. By D. H.

On Stoves. By L. H. B.

On Electrolysis and Demagnetization. By E. A. T.

Instrument for Investigating Pressure. By H. W. F.

Poetry. By T. S.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 27, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Acid, apparatus for the manufacture of nitric, P. Marcelin 227,097
Advertising device, E. W. Taylor 227,103
Air, apparatus for purifying and cooling, J. Edwards 226,939
Air compressor and water-lifter, L. S. Lawrence et al. 226,963
Auger, hollow, O. M. Bradley 226,969
Balance, differential, G. S. Palmer 227,050
Bale tie, E. Holman 226,951
Baling press, W. P. Groom 226,999
Barrels, rack for tiering, F. Stitsel (r) 9,175
Basket, J. W. Hugg 226,954
Beehive, Adair & Colbert 226,921
Bolting, manufacture of flexible, True & McDermott 226,943
Billiard chalk holder, F. Vane 226,944
Billiard table cushion, Bensinger & Goodrich 226,877
Boat, automatically dumping, N. Barney 226,930
Bolt holder, A. M. Colt 226,936
Book, blank, F. H. Richardson 226,930
Boot and shoe sole and heel plate, W. P. Whittier, Jr. 226,894
Boot and shoe uppers, machine for crimping, C. B. Long 226,992
Boots and shoes, machinery for crimping leather for, H. C. Pease 226,878
Bottle necks, machine for finishing, T. W. Synnott 226,900
Bottle, nursing, J. Thompson 227,078
Bottle stopper, M. W. Patten 226,936
Bottling machines, attachment for, M. W. Patten 226,937
Box fastener, W. Weis 227,182
Bridge, A. Snyder 227,088
Bridle nose piece, R. Arnold 226,964
Brooms and the case employed therein, packing, J. S. Tyrn 226,891
Buckle, G. W. Hart 226,914
Button, separable, W. P. Dolloff 226,948
Cue, I. Porter 227,002
Can, W. H. Van Vliet 226,945
Caster, E. Norton 227,046
Car brake and starter, C. W. Richardson et al. 226,901
Car coupling, Arter & Bloeber 226,916
Car coupling, E. T. Barlow 226,934
Car heater, S. F. Kellogg 226,962
Car, stock, C. A. Smith 226,996
Car, stock, J. Wood 226,967
Car, street, J. Andrew 226,922
Carbureter, gas, J. M. Palmer 226,973
Card, direction, R. P. Beatty 226,928
Carpet stretching apparatus, J. M. Joy 226,917
Carpet sweeper, H. A. Gore 226,947
Carriage jack, M. C. Burr 226,971
Cartridge, G. P. Salsbury 226,980
Check blank, metallic, J. Murdoch, Jr. 226,971
Check, monetary, J. O. Carpenter 226,976
Christmas trees, candle holder for, J. F. Young 227,080
Churn, A. Graves 226,911
Churn, I. Nicolkirk 227,045
Cigar bunching machine, M. Greenefelder 226,949
Cinder guard or deflector for railway carriage windows, A. Mitchell 226,969
Clasp knife, A. Friebertshauser 226,910
Coal washing machinery, S. Stutz 226,949
Coffee and tea pot, J. Binkley 226,890
Coin counting device, automatic, W. C. Morison 227,039
Collar pad, horse, W. K. Snyder 226,997
Copy holder, E. Noder 227,043
Corset and shoulder brace, comb'd, J. C. Schussler 226,960
Cotton gin, C. F. Brettergood 227,008
Cotton press, A. A. Janney 227,015
Counter alarm, Miller & Reichert (r) 9,177
Crucible furnace, J. Bergmann 226,928
Cultivator, B. C. Bradley 226,903
Curtain fixture, B. Handforth 227,003
Deaf to hear device for aiding the, Clarke & Foster 226,932
Dental speculum and shield, combined, A. W. Edwards 226,940
Desk, school, Fitts & Griffin 226,942
Distilling alcohol, process and apparatus for, G. W. Kidd 227,019
Distillation of whisky, separator for the, M. V. Monarch 227,032
Door hanger, A. N. Muntzer (r) 9,176
Double tree, J. J. H. Parrott 227,062

Drawing frame stop mechanism, D. W. Hayden. 227,022, 227,085
Drying apparatus, A. J. Kuhn 227,030
Dust pan, M. F. Pierce 226,977
Electric light, C. J. Van Depoele 227,059
Elevator, S. B. Conover 226,961
Elevator safety device, H. C. Goodrich 226,946
Enameling jewelry, etc., F. Kursh 227,021
Enameling or preparing mouldings for gilding, machine for, W. Glasgow 226,948
Envelope, E. Tompkins 227,073
Excavating and dredging machine, R. H. Osgood 226,976
Explosive compound, A. Monnier (r) 1,174
Fare register, E. Chesterman 226,935
Feed water heater, G. B. Strong 226,980, 227,053
Felly sewing machine, S. T. Kennan 226,961
File, newspaper, J. W. Hubbard 226,994
Firearm, breech-loading, W. H. Van Gieson 226,960
Fire extinguishing apparatus, Logan & Greenleaf 226,969
Fireplace attachment, F. S. Elsberry 226,902
Fire safe for smoke houses, W. H. Johnson 226,961
Fishing reel, G. Hancock 227,000
Flanging machine, Russell & McDonald 227,031
Filter for spooders, H. S. Josselyn 227,015
Flour and middlings from the products of crushed or ground wheat, removing, D. Sewell 227,004
Flower and pot, artificial, E. H. Moses 226,921
Furnace for annealing wire, etc., Hewitt & Withington 226,953
Galvanic battery, F. Tommasi 227,030
Garden rakes, machine for making, G. Banister 226,926
Gas engine, B. Huss 226,970
Gate hanger, F. Cook 141,990
Glass and other moulds, making, I. M. O'Donel 226,973
Glass annealing and tempering furnace, F. Siemens 226,934
Gold, etc., from ores, extracting, J. F. Boynton 226,965
Grain binder, C. W. Levalley 226,965
Grain drill attachment, S. F. Nesker 227,047
Grain drill feed cup, D. Berlew 226,903
Graves, device for filling, J. Holmes 226,926
Grinding and polishing wheel, J. W. Cole 226,970
Halter to prevent horses from cribbing, A. Madden 227,026
Handcuff, H. Ahrend 226,940
Handcuff, D. Allman 226,960
Harrow tooth, G. C. Winslow 227,066
Harrow, wheel, G. G. Crowley 226,900
Harvester, J. H. Elward (r) 1,179
Hat, felt, B. S. Nickerson 227,044
Hay and grain elevator, R. M. Deane 226,983
Hay fork, horse, Myers & Mountain 227,041
Hay stack cover, Bovee & Palmer 226,930
Hog ringing tool, J. Hessen 226,915
Horse foot protector, C. W. Greco 226,949
Horse power, M. Morton 227,007
Horse rake and hay spreader, combined, G. N. Palmer (r) 1,180, 9,181
Horseshoe, G. L. Potvin 226,979
Horseshoe blanks, machine for bending and forging, Holub & Locke 227,008
Horseshoe blanks, machine for creasing, punching, and swaging, Holub & Locke 227,009
Hub, carriage, S. T. F. Sterick 226,996
Hub, vehicle, A. B. McDonald 227,031
Hub, vehicle wheel, L. S. Edleblute 226,900
Ice cream freezer, D. J. Rogers 227,026
Ingot moulds, preparation for coating, A. L. Simondi 226,922
Journal bearing, R. W. Drew 226,907
Journals in machinery, device for lubricating, F. Crocker, Sr. 226,940
Ladder, step, D. C. Smart 226,900
Ladder, step, J. N. Valley 226,942
Lamp, C. Stockmann 227,071
Lamp, electric, W. G. Levison 227,025
Lantern, L. Henkle 226,923
Laths, machine for making metallic, C. H. Carter 226,931
Letter box, alarm, G. P. Herndon 227,006
Letter sheet and envelope, W. T. Berry (r) 9,171
Life raft, Raymond & Roberts 227,054
Link forming device, S. Uren 226,991
Locomotive engine, W. Mason 227,019
Loom heddle, J. H. Crowell 226,932
Loom heddle, S. Sewall, Jr 226,966
Lubricator, F. McDonough 226,969
Malt kiln, J. Jahel 226,980
Malt kiln, W. Toepfer 226,980
Matrix forming machine, H. L. Kimberly 227,017
Meat chopper, H. P. Rankin 9,189
Milk and other vessels, detachable discharge stopper and connection for, E. Cowles 226,939
Milk cooler, S. Hill 227,005
Motor for sewing machines and other purposes, Bowers & Harrison 226,927
Mower, lawn, J. B. Olcott 227,048
Music rack, W. F. Mills 227,034
Musical instruments, key board attachment for, J. F. White 227,083
Nitro-glycerine, manufacturing, F. Mann 226,967
Nozzle, noise-quieting, F. C. Curle 226,909
Nut lock, J. H. Wygant 226,947
Nuts, die for shaping, J. H. Sternbergh 226,926
Ore crushing machine, E. S. & H. M. Blake 226,964
Organ action, pneumatic, O. H. Needham 227,042
Packing piston rod, J. M. Bowers 226,922
Paddlewheel, W. P. Main 226,999
Paint can, F. W. Devoe 226,995
Pannier, M. A. Brynum (r) 9,178
Pantaloons, W. F. Borsell 226,926
Paper box, H. S. Runsom 226,972
Pen, stylographic fountain, E. D. Nimmo 226,904, 226,925
Pencil sharpening guide, J. K. Hoyt 227,013
Picture hanger, Haughtigan & Oldfield 227,046
Pistol, revolving, E. & L. Nagant 226,925
Planter check rower, corn, J. W. Hudson 226,959
Plow irons, device for welding, W. R. Hickman 227,006
Plow, rotary, St. John & Underwood 227,070
Plow, steam, T. H. McCray 226,921
Pocket knife, J. D. Frary 226,996
Pole, vehicle, W. Boughton 226,990
Printer's locking-up device, M. A. Hempel 227,004
Printing machine sheet delivery apparatus, Hoe & Tucker 226,916
Propeller, canal boat, T. Rose 226,931
Propeller, vibrating, S. Barnes 226,927
Pumping engine, steam, Cope & Maxwell 226,957
Pumping oil wells, apparatus for, E. D. Yates 226,966
Purse or satchel fastener, M. C. Larsen 227,023
Railway rails and rolling the pieces into merchantable bars, machine for splitting old, Holub & Locke 227,010
Railway rails, roll for forming billets from steel, F. B. Davis 226,942
Refrigerator, J. F. Ferguson 226,988
Rein holder for harness, check, J. W. Cooper 226,979
Rock drill, G. P. Schauser 227,062
Roofing and paving material, C. W. Warren 227,060
Roofing, composite tile, W. Dain 226,963
Rotary engine, F. Bergquest 226,929
Rubber, substitute for hard, G. A. Fudickar 226,944
Ruling machine pen lifter, J., W. A., & G. F. McAdams 227,103
Sad iron furnace, M. J. Mosher 227,036
Sad iron heater, M. L. Wells 227,081
Saw tooth swage, J. Clark 226,947
Sawing machine, W. Brodemann 226,909
Sawing machine, E. Culver 226,904
Scales, weighing, Barr & Axford 226,900
Screw, dumping, J. R. Knuth 227,019
Scythe blade, S. A. Millard 227,033
Sewing machine, Bayer & Lincoln (r) 9,176
Shawl strap, M. Rubin 227,060
Show box, O. Delisle 226,904
Show case, J. S. Gold 226,986
Show case and stand, S. A. Hoskins 226,987
Sifter, coal, I. F. Harris 226,918
Skate, combined runner and roller, E. Chesterman 226,935
Snow plow, D. M. Horton 227,011
Soap, compound, R. Lyon 226,920
Soda, making bicarbonate of, W. J. Menzies 227,033
Solar heater, J. P. Maussy 227,029
Spikes, machine for twisting, S. H. Wilson 227,094
Spinning spindle bolster, D. M. Smith 227,063
Stamp, perforating, J. J. Berger 226,962
Steam, apparatus for utilizing exhaust, D. Grimm 226,950
Steam boiler, upright, P. Quinn 226,980
Steam boilers, preventing explosions of, D. T. Lawson 227,024
Steam conducting pipe, J. Brosius 226,934
Steam engine pitman connection, F. C. Rowland 227,060
Steam trap, H. O. Ames 226,941
Stocking and method of manufacturing the same, W. Pope 226,979
Stove grate, W. Wiske 226,980
Stump extractor, M. Schmaly 226,984
Stump extractor, W. H. Wright 227,097
Sulky, A. Bedford 226,904
Sulky, trotting, W. J. Donley 226,907
Sulky, trotting, Wineman & Bohannon 227,086
Suspender pulleys, metallic housing for, T. O. Potter 226,980
Suspenders, H. Andres 226,902
Switch operating mechanism, L. H. Parkhurst 227,080
Teaching penmanship, hand guide for use in, L. Twitchell 226,943
Telegraph, duplex, A. Muirhead et al. 227,040
Telegraph, duplex, H. Van Hoevenbergh 227,073
Telegraph, quadruplex, Muirhead & Winter 227,040
Telephone and electro-magnet, combined, A. E. Dolbear 226,906
Telephones lines, call signal for, F. R. Richmond 227,056
Telephone switch board, T. G. Ellsworth 226,944
Thrashing machine, C. G. Case 226,973
Threshold strip, A. Baird 226,928
Tobacco grinding apparatus, S. V. Appleby 226,923
Tobacco, machine for measuring and packing, C. C. Clawson (r) 9,172
Tool handle fastening, L. H. Roberts 227,057
Top, J. R. Barry 226,928
Toy money box, J. H. Bowen 226,961
Tramway rail, T. S. Lambert 226,964
Trees, process and apparatus for changing the bearing year of fruit, G. B. Taft 227,074
Truck, adjustable, Green & Roberts 226,967
Truck, stove, E. F. Johnson 227,014
Turn table, C. A. Greenleaf 226,988
Turning balusters, machine for, P. M. Haas 226,912
Valve and chest, glass, E. P. Smith 227,067
Vehicle dash board foot, Thompson & Hayward 226,941
Vehicle seat, J. H. Babbitt 226,926
Vehicle spring, L. Pulliam 226,939
Vehicle spring, W. R. Richmond 226,982
Vise, C. Fisher 226,941
Wagon brake, automatic, W. H. Johnson 227,014
Wardrobe for trunks, portable, I. Rogeland 226,986
Washstands, etc., seal joint trap for, J. Bonner 226,961
Washing machine, Freilocher & Mahler 226,981
Washing machine, T. Borg, Jr 226,937
Washing machine, R. A. Clark 226,978
Watch cases, device for making bezels and backs for, T. Mueller 226,970
Water motor, W. Lay 227,036
Water wheel, W. Sims 227,069
Weather strip, S. A. Piper 227,051
Wheel guard, S. Briese 226,970
Whiffletree, F. R. Wilson 226,994
Wire barbing machines, tension apparatus for, I. R. Whiteman 226,946
Wire, manufacture of draw plates for drawing, C. D. Rogers 226,980
Wool washing machine, Proctor & Knowles 227,053
Work table, lady's, O. E. Stein 227,069

DESIGNS.

Funeral ornaments, W. B. Smith 11,734
Handkerchief, J. Grimshaw 11,731
Jewel case and clock, H. J. Davies 11,746
Knife handles, pocket, J. D. Frary 11,749, 11,750
Mementos for perpetuating the memory of deceased friends and relatives, E. W. Donovan 11,736
Monuments of Egyptian obelisk, R. Busteed 11,735
Saw blades, A. H. Loebs 11,732
Stocking fabric, ornamental, J. E. Hanifen 11,730
Stoves, W. C. Davis 11,747, 11,748

TRADE MARKS.

Cigars, cigarettes, and smoking and chewing tobacco, Jaeger Brothers 7,982
Embroideries, cotton, J. A. Oberstelier 7,986
Fever and ague, remedy for, D. Wiehl & Co. 7,985
Leather goods, certain fancy, B. Posen & Co. 7,980
Leather, kid, Combe & Ortel 7,988
Medicinal compounds, certain, W. H. Randle 7,989
Medicine for rheumatism, neuralgia, and similar diseases, Carver & Stacy 7,987
Salves, F. Wilharm 7,984

English Patents Issued to Americans.

From April 27 to April 30, 1880, inclusive.

Electric signal apparatus for railroads, G. Gassett, Boston, Mass.
Hoe, B. L. Turner, Olena, Ohio.
Horseshoes, manufacture of, J. D. Billings, N. Y. city.
Ice making machinery, C. C. Palmer, Oakland, Cal.
Knife and fork polishing machine, J. Cheek, N. Y. city.
Lubricating apparatus, F. Crocker, Olean, N. Y.
Registering apparatus for cars, etc., N. A. Ransom, Chicago, Ill.
Rivets, bolts, etc., machine for rolling, J. H. Whitney, New York city.
Screw bolts and nuts, substitute for, N. Thompson, Brooklyn, N. Y.
Ship's Berths, T. O. L. Schrader, New York city.
Steam boilers, means for preventing explosion of, D. T. Lawson, Wellsville, Ohio.
Steel, treatment of, J. Haldeman, New York city.
Telephones, O. Russell, Brooklyn, N. Y.
Vehicle axles and running gear of, P. Herdic, Williamsport, Pa.
Wheels for railroad vehicles, A. F. Cooper, Cambridge, Mass.

Advertisements.

VALUABLE BOOKS ON PAINTING AND VARNISHING.

A Practical Treatise on the Manufacture of Colors for Painting: Comprising the Origin, Definition, and Classification of Colors; the Treatment of the Raw Material; the best Formulæ and the newest Processes for the Preparation of every description of Pigment, and the necessary Apparatus and Directions for its Use; Driers; the Testing, Application, and Qualities of Paints, etc., etc. By MM. Riffault, Vergnaud, Toussaint, and M. F. Malepeyre. From the French by A. A. Fesquet. 80 engravings. 8vo. $7.50.

A Practical Manual of House-Painting, Graining, Marbling, and Sign Writing. With nine colored Illustrations of Woods and Marbles, etc. By E. A. Davidson. 12mo. $3.

Painter, Gilder, and Varnisher's Companion. Containing rules and regulations in everything relating to the Arts of Painting, Gilding, Varnishing, Glass Staining, Graining, Marbling, Sign Writing, Gilding on Glass, and Coach Painting and Varnishing; Tests for the Detection of Adulterations in Oils, Colors, etc. Sixteenth edition, revised, with an appendix. Containing Chevreul's Principles of Harmony and Contrast of Colors, etc. 12mo. 184 pages. $1.50.

Sign Writing and Glass Embossing. A Complete, practical Illustrated Manual of the Art. By James Callingham. 12mo. $1.50.

A Complete Guide for Coach Painters. Translated from the French of M. Arlot, Coach Painter. By A. A. Fesquet, Chemist and Engineer. 12mo. $1.25.

☞ The above or any of our Books, sent by mail, free of postage, to any part of the world, at the publication prices.

Our new and enlarged Catalogue of Practical and Scientific Books—96 pages, 8vo—and other Catalogues sent free to any one who will furnish his address.

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS AND BOOKSELLERS,
810 WALNUT STREET, PHILADELPHIA.

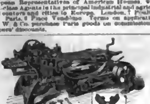
"RELIABLE"

Engines a complete success. Prices still 40 per cent. below those of other makers. Unequaled for efficiency, simplicity, and durability. Prices from $150 for 10 H. P., to $600 for 35 H. P. All complete, with Governor, Pump, and Heater.

Address, for circular,
HEALD, SISCO & CO.,
Baldwinsville, N. Y.

JOHN R. WHITLEY & CO.

European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E. C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.



SWEEPSTAKES, WITH THE ELLIS Patent Journal Box. The best Planer and Matcher ever made. Planing 20 in. wide, 6 in. thick, weight 2,100 lbs., $350; planing 24 in. wide, 6 in. thick, weight 2,800 lbs., $400. Beading, Arbor and Head, extra, $25. Sash, Door, and Blind Machinery a specialty. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

An engine that works without Boiler. Always ready to be started and to give at once full power. SAFETY, ECONOMY, CONVENIENCE. Burns common Gas and Air. No steam, no coal, no ashes, no fires, no danger, no extra insurance. Almost no attendance.

THE NEW OTTO SILENT GAS ENGINE.

Useful for all work of small stationary steam engine. Built in sizes of 2, 4, and 7 H. P. by SCHLEICHER, SCHUMM & CO., 3045 Chestnut Street, Phila., Pa. H. S. Manning & Co., 111 Liberty St., N. Y., Agents.

AIR COMPRESSORS.

THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.

Bookwalter Engine.

Compact, Substantial, Economical, and easily managed; guaranteed to work well and give full power claimed. Engine and Boiler complete, including Governor, Pump, etc., at the low price of

3 HORSE POWER	$240 00
4½ " "	280 00
6½ " "	355 00

☞ Put on cars at Springfield, O.
JAMES LEFFEL & CO.,
Springfield, Ohio,
or 110 Liberty St., New York.

THE DINGEE & CONARD CO'S BEAUTIFUL EVER-BLOOMING ROSES

THE BEST IN THE WORLD.

Our Great Specialty is growing and distributing these Beautiful Roses. We deliver Strong Pot Plants, suitable for immediate bloom, safely by mail at all post-offices. 5 Splendid Varieties, your choice, all labeled, for $1; 12 for $2; 19 for $3; 26 for $4; 35 for $5; 75 for $10; 100 for $13. ☞ Send for our New Guide to Rose Culture—60 pages, elegantly illustrated—and choose from over Five Hundred Finest Sorts. Address

THE DINGEE & CONARD CO.,
Rose Growers, West Grove, Chester Co., Pa.

CARNEGIE BROS & CO.
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought STRUCTURAL IRON. It is believed that, were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders, on application.

RUBBER BACK SQUARE PACKING.

BEST IN THE WORLD.

For Packing the Piston Rods and Valve Stems of Steam Engines and Pumps.

B represents that part of the packing which, when in use, is in contact with the Piston Rod.
A the elastic back, which keeps the part B against the rod with sufficient pressure to be steam-tight, and yet creates but little friction.
This Packing is made in lengths of about 20 feet, and of all sizes from ¼ to 2 inches square.

JOHN H. CHEEVER, Treas. NEW YORK BELTING & PACKING CO., 37 & 38 Park Row, New York.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
233 BROADWAY, NEW YORK.

THE SKINNER & WOOD PORTABLE & STATIONARY ENGINES, BOILERS & GOVERNORS. FIRST CLASS & ECONOMICAL. SKINNER & WOOD, ERIE PA. SEE ILLUSTRATED ADVERTISEMENT.

Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON, 26 Salisbury Street, Worcester, Mass. (Shop formerly occupied by R. BALL & CO.)

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

SHEPARD'S CELEBRATED
$60 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.

H. L. SHEPARD & CO.,
331, 333, 335, & 337 West Front Street,
Cincinnati, Ohio.

AHEAD OF ALL COMPETITION! 1880.

The PHILADELPHIA LAWN MOWER.

EIGHT SIZES FOR HAND USE.
Weighing from 22 to 51 lbs.
THREE SIZES FOR HORSE POWER.

The very large increase in our sales last year prove that these machines fully sustain the awards "AS THE BEST" made to them at the great Centennial "hundred day trial," in Philadelphia, in 1876, and their complete victory at the Paris Exposition in 1878. We offer for 1880 Machines from entirely new patterns and greatly improved in every respect.

Examine our New Lawn Sweepers. Hand or Horse size.

GRAHAM, EMLEN & PASSMORE,
Patentees and Manufacturers,
631 Market St., Philadelphia, Pa.
Send for Descriptive Catalogue with prices.

THE Eclipse Engine

Furnishes steam power for all Agricultural purposes, Driving Saw Mills, and for every use where a first-class and economical Engine is required. Eleven first-class premiums awarded, including Centennial, '76. Refer to No. 7, issue of '77, No. 14, issue of '78 of SCIENTIFIC AMERICAN, for Editorial Illustrations.

FRICK & CO., Waynesboro, Franklin Co., Pa.
When you write please name this paper.

ACME STEAM PUMPS, FOR EVERY DUTY.

VALLEY MACHINE CO.,
EASTHAMPTON, MASS.

SPARE THE CROTON AND SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 233 Broadway, N. Y., who control the patent for Green's American Driven Well.

WOOD WORKING MACHINERY.
PLANING, MATCHING, MOLDING, MORTISING, TENONING, CARVING, MACHINES
BAND & SCROLL SAWS
UNIVERSAL VARIETY WOOD WORKERS &c. &c.
J. A. FAY & CO.
CINCINNATI, O. U. S. A.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

The George Place Machinery Agency

Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

IMPLEMENTS, MACHINERY, ETC.

Catalogues, prices, and Agency terms solicited. Unexceptional references. OSKAR NETZLER, Agent in Brisbane, Queensland, Australia.

THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

Grain Speculation

in large or small amounts. $25 or $25,000. Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., CHICAGO, ILL., for Circulars.

TELEPHONE

Works 1 mile. Price $3.50. Pat'd. Circulars free. HOLCOMB & Co., Mallet Creek, Ohio.

B. W. PAYNE & SONS, CORNING, N. Y.
ESTABLISHED 1840.

Patent Spark-Arresting Engines, mounted and on skids. Vertical Engines with wro't boilers. Eureka Safety powers with Sectional boilers—can't be exploded. All with Automatic Cut-Offs. From $150 to $2,000. Send for Circular. State where you saw this.

"BLAKE'S CHALLENGE" ROCK BREAKER.

Patented November 18, 1879.

For Macadam Road making, Ballasting of Railroads, Crushing Ores, use of Iron Furnaces, etc. Rapidly superseding our older styles of Blake Crusher on account of its superior strength, efficiency, and simplicity. Adopted by important Railway and Mining Corporations, Cities, and Towns. First Class Medal of Superiority awarded by American Institute.

BLAKE CRUSHER CO., Sole Makers, New Haven, Conn.

Delamater Steam Pumps,

For every variety of work.

WATERWORKS PUMPING ENGINES.

DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
Office, No. 10 CORTLANDT ST.,
Works, Foot of W. 13th St., North River, New York.
ESTABLISHED 1841.

$777 A YEAR and expenses to agents. Outfit Free. Address P. O. VICKERY, Augusta, Maine.

See illustrated editorial in SCIENTIFIC AMERICAN, August 3d, 1878.

THE HOLLY SYSTEM FOR HEATING cities and villages, under the Holly Patents, is in practical operation in many places. For economy, comfort, and convenience, is superior to any other principle. Licenses granted to corporations for the use of this system. Holly Steam Combination Co., Lim., Lockport, N. Y.

SEND STAMP FOR CATALOGUE
TOOLS
TAPS & DIES, VISES, LATHE CHUCKS, MACHINE SCREWS, LATHES, FILES, STEEL
TALLMAN & McFADDEN, PHILADELPHIA.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.

Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

AGENTS Catalogue free. $7 per day made easy. J. P. GAGE & CO., Boston, Mass.

The "Bergner" Non-Conductor, for Heated Surfaces. Applicable to plane or curved surfaces, pipes, elbows, and valves. Easily applied, efficient, and inexpensive. Bergner Steam Pipe Covering Co., 12th and Ridge Ave., Phila., Pa.

To Electro-Platers.

BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with Books of Instruction for Gold, Silver or Nickel Plating. THOMAS HALL, Manufacturing Electrician, 19 Bromfield Street, Boston, Mass. Illustrated Catalogue sent free.

STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.
709 Market St., St. Louis, Mo.

THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.

WORTHINGTON STEAM PUMPS of all sizes and for all purposes.

Prices below those of any other steam pump in the market.

WATER METERS. OIL METERS.

TIGHT & SLACK BARREL MACHINERY
A SPECIALTY
JOHN GREENWOOD & CO.
ROCHESTER N.Y.

No Sawdust! No Planing!

Thin lumber, 1-16 to ½ inch thick, cut and seasoned by our recently patented machines, equal if not superior to the sawed and planed wood, being smooth, flat, and in all cases perfectly seasoned. Used by the largest manufacturers in the country, and giving entire satisfaction. In addition to our specialty, our usual complete stock of sawed Hardwood, Lumber, and Veneers, figured and plain, Burls, etc.

GEO. W. READ & CO.,
186 to 200 Lewis Street, New York.

PATENTS

CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 20, 1866, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 20, 1866, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.
BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

ROOTS' NEW IRON BLOWER.

POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED,
IS SIMPLER, AND HAS
FEWER PARTS THAN ANY OTHER BLOWER.
P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.

S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 9 Dey Street, NEW YORK.
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 9 Dey Street,

☞ SEND FOR PRICED CATALOGUE.

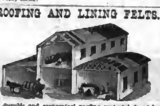
Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

ROOFING AND LINING FELTS.



A durable and economical roofing material furnished for $2.25 per square (10x10). *Waterproof Sheathing Paper*, for lining houses, depots, etc., 45 cents per square (10x10). Send for samples and circular. E. H. MARTIN & CO., P. O. Box 2004. 70 Maiden Lane & 9 Liberty St., N. Y. City.

GOOD BUSINESS FOR SALE.

Owing to ill health, the subscriber offers for sale his interest in the Iron Foundry and Machine Shop of T. H. Risdon & Co.

This establishment manufactures the celebrated Risdon Water Wheel, which excelled all competitors at the test of turbines at the Centennial Exhibition. This is a rare chance to obtain an interest in a long established and prosperous business.

Will be sold cheap and on accommodating terms.
Apply to T. H. RISDON (private),
Mount Holly, N. J.

HODGKINS & HAIGH,
Importers, Manufacturers, and Dealers in
FIRE ARMS AND SPORTING GOODS,
300 BROADWAY, NEW YORK.
Every article of substantial merit known to the Trade supplied, and orders solicited.

H.W. JOHNS' ASBESTOS Liquid Paints.

These are the purest, finest, richest, and most durable paints ever made for structural purposes. They are prepared ready for the brush in sixteen newest shades and standard colors, suitable for the tasteful decoration of dwellings and all classes of buildings, inside and out, and for all purposes where a perfect protective coating is required, and covering body and durability considered, *they are twenty-five per cent cheaper than the best White Lead or any other kind of paint now in use.*

☞ *Be Sure and Get the GENUINE, Which Are Manufactured Only by*

H. W. JOHNS M'F'G CO.,
87 Maiden Lane, New York.
Sole Manufacturers of Genuine Asbestos Roofing, Boiler Coverings, Sheathings, &c.
☞ Special Prices to large consumers. Samples of Colors and Descriptive Price Lists sent free.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SONS, Buffalo, N. Y.

FOR SALE OR RENT, AT A MERELY nominal figure, the Camden and Amboy R. R. Shops, at Bordentown, N. J. For descriptive circular, address BOARD OF TRADE, Bordentown, N. J.

TELEGRAPH and Electrical Supplies. Send for Catalogue. C. E. JONES & BRO., CINCINNATI, O.

J. STEVENS & CO.,
P. O. Box 28, Chicopee Falls, Mass. Manufacturers of Stevens' Patent Breech-Loading Sporting and Hunters' Pet Rifles, Single and Double Barrel Shot Guns, Pocket Rifles, Pocket Shot Guns, Gallery Rifles, Superior Spring Calipers and Dividers, including the New Patent Call Spring Calipers; also Double Lip Countersinks and Hatheways' Patent Combination Gauge.

ADJUSTABLE INCLINE PRESSES, STILES & PARKER PRESS CO., Middletown, Conn.

GLASS SIGNS.

Transparent Colored Glass Signs, by a new process. Cheaper than sand blast or acid work. Fine work, trade marks, designs, etc., that cannot be done by any other method.
CHEMICAL GLASS SIGN CO., Lim.,
P. O. Box 3366. 9 Barclay St., New York.

THE MACKINNON PEN OR FLUID PENCIL.

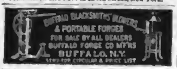
Particulars mailed Free.
MACKINNON PEN CO.,
200 Broadway, near Fulton St., N.Y.

The New York Ice Machine Company,
21 Courtlandt Street. Room 54.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more Ice. Uses only ¾ water of condensation. No Pressure at rest. Pressure in running, 14 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

COLUMBIA BICYCLE.
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of *The Bicycling World*.
THE POPE M'F'G CO.,
89 Summer Street, Boston, Mass.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements,
from 10 to 1,000 H. P.

BOILER COVERINGS.
Plastic Cement and Hair Felt, with or without the Patent **"AIR SPACE"** Method.
ASBESTOS MATERIALS,
Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John Street, and Foot of E. 9th Street, New York.



WOOD SOLE SHOES.
The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send stamp for circular and price list.
CHAS. W. COPELAND,
122 Summer St., Boston, Mass.

BUY NO BOOTS OR SHOES
Unless the soles are protected by Goodrich's *Bessemer Steel Rivets*. Guaranteed to outwear any other sole. All dealers sell them. Taps by mail for 75 cents in stamps. Send paper pattern of size wanted. H. C. GOODRICH, 19 Church St., Worcester, Mass.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

The Rodier Patent Single Iron Plane.

Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

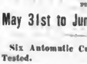
GENUINE BABBITT METAL.
Fine Brass and Composition Castings.
E. STEBBINS M'F'G CO., SPRINGFIELD, MASS.

ILLUSTRATIONS OF ALL KINDS MADE QUICKLY AND CHEAPLY.

ILLUSTRATED CIRCULAR SENT ON RECEIPT OF STAMP.

A PLANING MILL OUTFIT FOR SALE very low for cash. Will sell all together or each machine separate. All first-class machines, good order.
J. H. KERRICK & CO., Indianapolis, Ind.

ROOFING.
For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.



"BUCKEYE" LAWN MOWER.
The lightest and easiest running MOWER ever made.
STRICTLY FIRST CLASS.
MAST, FOOS & CO.,
Springfield, Ohio.
Send for catalogue.

FIRST GRAND
Millers' Exhibition,
TO BE HELD IN
EXPOSITION BUILDINGS, IN CINCINNATI,
FROM
May 31st to June 26th inclusive.

Six Automatic Cut-off Engines to be Tested.

Ten Complete Flour Mills in Operation.

A Complete Vienna Bakery.

Mill Machinery from all Quarters of the Globe.

Reduced Railroad Rates.

Ample Hotel Accommodations.

WIRE ROPE
Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.
Wheels and Rope for conveying power long distances. Send for circular.

SECOND-HAND BLAKE CRUSHER for sale cheap. New pattern, 15x9.
Address P. O. Box 221, Baltimore, Md.

Pictet Artificial Ice Co., Limited,
P. O. Box 3083. 142 Greenwich St., New York.
Guaranteed to be the most efficient and economical of all existing Ice and Cold Air Machines.

The Asbestos Packing Co.,
Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:
PATENTED ASBESTOS ROPE PACKING,
" " LOOSE "
" " JOURNAL "
" " WICK "
" " MILL BOARD,
" " SHEATHING PAPER,
" " FLOORING FELT,
" " CLOTH.

PERFECT SECURITY AGAINST
The Rubber-covered Carriage Step is the safest and handsomest step made, and is fast superseding the old iron step on fine carriages. Durability warranted. Carriage builders will be sure to please their patrons by adopting this improved step. For sale by dealers in Carriage Goods. RUBBER STEP M'F'G CO., Boston, Mass.
ACCIDENTS FROM SLIPPING

Working Models
And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

PORTLAND CEMENT,
From the best London Manufacturers.
K. B. & S. AND BURHAM CEMENTS.
For sale by JAMES BRAND, 85 Beekman St., New York.

FRIEDMANN'S PATENT
EJECTORS
Are the cheapest and most effective machines in the market for
Elevating Water and Conveying Liquids
from Mines, Quarries, Ponds, Rivers, Wells, Wheel Pits; for use in R. R. Water Stations, Factories, etc. They are splendidly adapted for conveying liquids in Breweries, Distilleries, Sugar Refineries, Paper Mills, Tanneries, Chemical Works, etc. Send for illus. catalogue to
NATHAN & DREYFUS,
Sole Manufacturers. NEW YORK.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES
AND
AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL Co
SEND FOR PAMPHLET. FITCHBURG MASS

CHICAGO, May 19, 1880.
CORNER IN WHEAT.
Grand opportunities to deal with $25 or $25,000. Write
W. T. SOULE & CO.,
130 LaSalle St., Chicago.

BURGESS' PORTABLE
MECHANICAL BLOW PIPE
Supersedes the Forge, Bellows, and Mouth Blow Pipe by saving time, labor, and breath. Gives the grandest flame or hottest blast without exertion.
J. ELLIOTT SHAW, 124 S. 8th St., Phila., Pa.

FOR SALE.—One of Waters' Patent Feed Water Heaters. Was in use about two years. Believed to be as good as new. Cost $225. Will be sold for $75.
SCHOOL & BLAKELY, Evening Star Office, Phila., Pa.

EXPERT BOOKKEEPER, WITH FIFTEEN YEARS' valuable experience, desires position where he can earn $2,000 per annum. JOHN LOUIS, Station E, New York.

BROWN'S PAT. SPLIT PULLEYS
Shafts, Hangers.
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

OF THE
Scientific American
FOR 1880.
The Most Popular Scientific Paper in the World.

VOLUME XLII. NEW SERIES.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

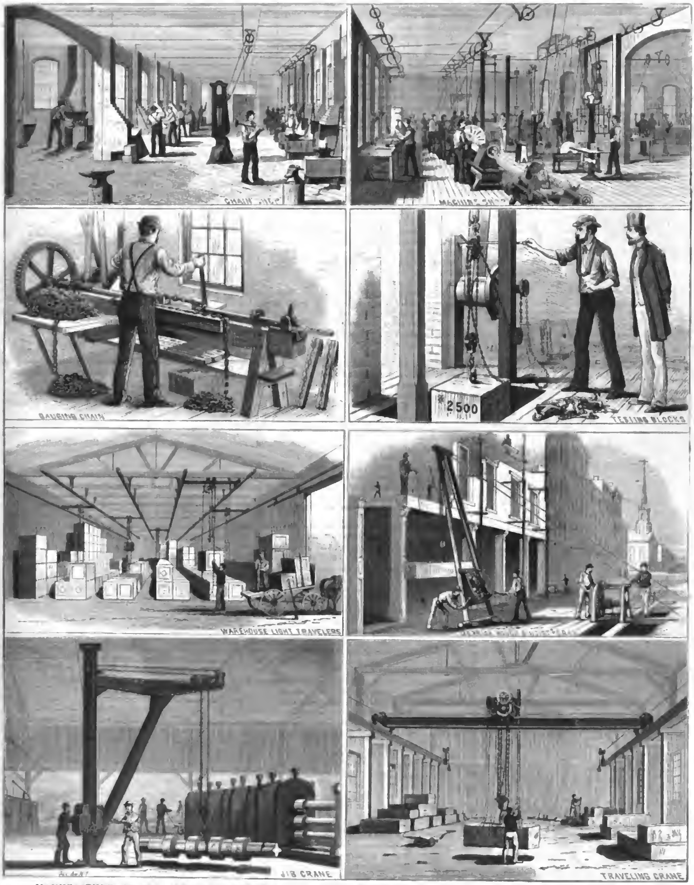
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 23. [NEW SERIES.] | NEW YORK, JUNE 5, 1880. | [$3.20 per Annum. [POSTAGE PREPAID.]]



MANUFACTURE OF THE WESTON DIFFERENTIAL PULLEY BLOCK, YALE LOCK MANUFACTURING CO.—[See page 357.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, JUNE 5, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 231.

For the Week ending June 5, 1880.

Price 10 cents. For sale by all newsdealers.

AN EPIDEMIC OF GOLD DISCOVERY.

Reports of gold discoveries in Maine or beyond the Rocky Mountains are matters of everyday occurrence and surprise no one. There seems to have been of late, however, a remarkable outbreak of such reports from other parts of the country.

To begin at home, there is the report from Albany, April 29, that Albert Stolpp, of Brooklyn, has filed official notice with the Secretary of State that he has discovered a well-defined vein of gold and silver in the town of Cornwall, Orange County, N. Y.

A dispatch from Milwaukee, Wis., April 23, says: "Much excitement prevails at Ashland over the reported discoveries of gold and silver, in paying quantities, at Brunschwiller and Silver Creek, fourteen miles south of Ashland."

From the Baltimore *Gazette*, of April 22, we learn that persons residing in the vicinity of Catonsville, Baltimore County, have indulged in a good deal of speculation the past few days in regard to the value of a gold deposit discovered by Mr. F. Marion Hay upon a tract of land owned by him and situated eight miles from Baltimore, on the old Frederick road, in close proximity to "Glenwild," the country seat of Mr. George Appold. Immediately after purchasing the property, about one year ago, Mr. Hay sank an artesian well to the depth of 150 feet, and being satisfied that valuable mineral existed, began to sink a shaft six feet in width, but was compelled to suspend operations during the winter. The shaft has now been completed, and the quartz containing the gold was reported yesterday by those engaged in the work as having been assayed at $30 per ton. Mr. Hay is sanguine that the precious metal will be found in paying quantities, and operations thus far seem to verify his prediction. The work progresses night and day, two sets of men being employed.

A dispatch from Atlanta, Georgia, dated April 13, says that considerable excitement prevails in White County over the find of rich pockets of gold in Nacoochee Valley. Over a hundred nuggets were taken out in four days, one of which, shown in Atlanta, weighs over a pound and an ounce. The yield grows richer as the washing proceeds.

Another report from the same place, dated April 24, says that the gold fever is spreading, especially in White County. Lumsden Bros., at Nacoochee, have taken out 2,700 pennyweights in nuggets from 80 square feet of earth at a total expense of $65. From a pocket 30 inches square they gathered 212 pennyweights in small nuggets. Another party that struck the same lead took out, before they began to clean up, a nugget that weighed 106 pennyweights, and several others not quite so heavy.

Favorable reports are also made from the lately reopened gold mines of North Carolina.

All these may be genuine "finds," to be followed by profitable developments; nevertheless it will not do to base extravagant hopes upon them. Too often, as Prof. Stewart remarks in a recent report on certain Maine mines, such discoveries are made "by new-fledged prospectors, who are utterly ignorant of the elementary principles of geology and mineralogy. They hastily squat on a protruding trap dike, and develop 'the find' by excavating a shallow potato pit, and imagine themselves bonanza kings if they encounter a stringer of mundic or fragment of copper pyrites. 'It takes a mint to work a mine.' Skill, capital, and experience are needed to run a mine successfully; and any attempt to manage the business without these will end disastrously."

Where the Islands and Sand Bars in the Mississippi River Come From.

From a series of daily observations extending from the early part of February to the latter part of October, 1879, taken at St. Charles, Mo., under the direction of officers of the United States Engineer Corps, it has been ascertained that the average quantity of earthy matter carried in suspension past that point by the Missouri River, between one foot of the bottom and the surface, amounts to 14,858 lb. per second, or 1,283,731,200 lb. each twenty-four hours. The matter thus carried along weighs, approximately, 100 lb. per cubic foot when dry, giving an average of 12,837,312 cubic feet of earth transported each twenty-four hours during the entire year, enough to cover one square mile with a depth of nearly six inches.

During the months of June and July the average quantity per twenty-four hours amounted to 47,396,448 cubic feet, enough to cover a square mile with a depth of one foot and eight inches. The maximum quantity observed for any twenty-four hours was on July 3, when it reached the enormous amount of 111,067,200 cubic feet, sufficient to cover a square mile to a depth of four feet. These figures do not take into account the material that is held in suspension within the lowest foot of the depth, or that which is being rolled along the bottom. If these quantities could be ascertained within any reasonable limit of approximation to correctness, there is no doubt but they would show an amount far in excess of that which has already been determined.—*Missouri Republican.*

ANOTHER LOST FIELD GLASS.

The articles which appeared in this paper some months ago relative to Prof. Barker's paper before the American Science Association on a curious case of crystallization in Canada balsam, have called out a note from Prof. Liversidge, of the University of Sydney, New South Wales, inclosing a printed paper on the same phenomenon read by him before the Royal Society of New South Wales, December 1, 1875. The paper is illustrated by two fine engravings from photographs, representing "some peculiar and interesting examples of fracture." Prof. Liversidge said:

"They were met with upon the lenses of a field-glass, or, to speak more precisely, between the surfaces of the achromatic combinations of the two object glasses of a field-glass, which had been lost upon the Liverpool Plains, and there left exposed to the sun and weather for a period of five or six years. The long continued exposure to alternate heat and cold had evidently caused the Canada balsam, or other material used for cementing the crown and flint glass portions of the lenses together, to contract and crack along certain lines; the contraction and consequent fractures being due to the loss of turpentine from the balsam by gradual volatilization."

Our readers will remember that Prof. Barker's supposed crystallization of gum took place between the lenses of a field glass which had been lost in the Yellowstone country and there exposed to the weather for a number of months. The true explanation of the crystalline appearance was given by Mr. Hopkins in the SCIENTIFIC AMERICAN of Jan. 31, 1880.

Arctic Relief.

Captain Hooper, commanding the revenue steamer Corwin, has been ordered to leave San Francisco, Cal., May 22, for the relief of ice-bound whalers and to search for the Arctic exploring vessel Jeannette. He will proceed direct to Ounalaska, where he will take in a fresh supply of coal; then go on to Norton's Sound, touching at the seal islands by the way. He is to push through Behring Straits into the Arctic Ocean as soon as those waters are open, and assist such whalers as may need help, making meantime, as his letter of instructions reads, careful inquiries regarding the progress and whereabouts of the steamer Jeannette, engaged in making explorations under the command of Lieutenant Commander De Long, United States Navy, and, if practicable, communicate with and extend any needed assistance to that vessel.

A FAST RIVER STEAMER.

During her trial trip, May 12, the new iron hull steamboat Albany, for the Hudson River day line to Albany, ran a distance of 16 miles in 37¼ minutes, a speed of nearly 26 miles an hour. The state of the tide was not reported. Her owners expect that she will easily run 24 miles an hour.

The Albany is the largest steamer built thus far for the day service, and will have ample accommodation for 2,000 passengers. The dimensions of the hull are 296 feet in length, 40 feet beam (73½ feet over all), and 11½ feet depth of hold. The engines were made by Fletcher, Harrison & Co., and are of the vertical beam condensing pattern, with a 73 inch cylinder, a 12 foot stroke, and capable of running up to 3,000 horse power. There are three boilers, 33 feet long each, and 8 feet 10 inches in diameter of shell. The joiner work is being done by Mr. John E. Hoffmeyer. Every recent improvement looking toward increased safety has been provided. The hull, which is of iron, was built by the Harlan and Hollingworth Company, of Wilmington, Del. The engine frame is also of iron, and very compact.

There are three decks, the main, saloon, and upper decks, the main and saloon decks will be for the use of passengers, and the upper deck for the officers. The dining room is on the main deck instead of in the hold, as is usual. The saloon will be elaborately frescoed and upholstered. The forward and after parts are left open on the sides. The after portion is covered by the upper deck. The forward part is entirely open. She will be ready for service about the middle of June.

IMPROVEMENTS AT COHOES.

The importance of Cohoes, N. Y., as a manufacturing city largely depends, as our readers are doubtless aware, upon the magnificent water power furnished by the falls of the Mohawk River at that point, as improved by the Cohoes Water Power Company. This company owns the entire power of the river from half a mile above the falls to a mile below, the total fall in that distance being 120 feet. The water is used in five successive canals, having falls of 18 to 25 feet, and again from the level of the State dam built below the falls to supply the Erie Canal at this point.

From the *Northern Budget* we learn that the Cohoes Company have just begun an important extension of their works. The first part includes the cutting of a channel through solid rock from Van Rensselaer street, up Ontario street, to intersect the canal at Lansing's Mill, a distance of 600 feet, the width of the cut being 35 feet, and the depth 20 feet. From the corner of Ontario street a similar canal, 800 feet long, 30 feet wide, and 20 feet deep through solid rock, is to be cut beside the railway track, to connect with the canal at the Cohoes foundry. Both these cuttings are to be securely arched. The rock removed will be used for filling in land in rear of Root's Mill. The water to feed this canal is now running to waste from the Lansing Mill. The land along the canal will furnish 2,000 feet of mill frontage. The further improvements in contemplation involve an extension of the Rensselaer street canal a distance 1,500 feet. Two lines of canal will be constructed the entire distance, making available a fall of 40 feet. These improvements will give, the *Budget* remarks, a water power second to none in the world, and will in time no doubt convert the city of spindles into the largest cotton manufacturing center on this continent.

POISONOUS FRYING PANS.

When our rival tea dealers began to offer badly printed and gaudily colored chromos to draw custom, it was thought that this form of trade debasement had reached its lowest development. The tea men of Dublin, however, have gone on from æsthetic to physical poisoning, and have distributed throughout that city large numbers of frying pans coated with an alloy of tin and lead, the use of which has resulted in numerous cases of serious poisoning. At a late meeting of the Section of Physical and Experimental Science of the Royal Dublin Society, Dr. Reynolds, the president, exhibited one of these dangerous frying pans, which had been sent to him for analysis. The pan was of the ordinary sheet iron sort, but instead of having the usual coating of tin, was covered with an alloy very rich in lead, making it exceedingly dangerous to public health. On inquiry, Dr. Reynolds had found, he said, that large numbers of those pans were being presented with more or less large quantities of tea through the city, and he might tell them that the friend of his who suffered from cooking conducted in one of those pans had nearly lost her life. Her servant—a very much stronger person—consumed very much more of the food that was in the pan, and consumed not only the sausages, he believed, but, foolishly enough, took also of the gravy, or whatever it was, and accordingly took a larger dose of the lead. Not only did she suffer from very serious symptoms, but was obliged to go to the hospital, and he did not know whether or not she had yet left it. Of course, in some cases, a small dose of the lead might do little or no harm, but there were many chances that an amount of lead which must be considerable, taken up by any acid-producing food, might enter the system, and positively cause symptoms resembling in some respects, as all kinds of irritant poisons did, those of cholera, and it was possible that many cases of death, which might be set down readily enough to ordinary English cholera, might have been produced by the introduction into the system of considerable quantities of lead.

On being asked how to detect the dangerous frying pans, Dr. Reynolds described and experimentally illustrated the following simple method. A little nitric acid diluted with water was boiled in the suspected pan. The mixture was then further diluted with pure water and poured into a clean vessel. The presence of lead was shown by adding a little iodide of potassium, which produced at once a yellow precipitate of iodide of lead.

The tea dealers had probably bought these pans to "give away," because they were cheap, knowing nothing of their dangerous character. Whether any of the sort have reached our markets we do not know. It would be well, however, for buyers to be on their guard. Five cents' worth of iodide of potassium and nitric acid, which can be had of any druggist, would suffice for the test.

CARP CULTURE.

A leather-back carp, weighing 7½ lb., has lately been taken in the government ponds at Washington. It was one of the original fish brought to this country by Mr. Hessel three years and a half ago. This shows a rate of growth far exceeding that of the same fish under similar circumstances in Europe. Several marked advantages are claimed for the German carp for profitable cultivation. Any kind of pond, no matter how restricted, can be used. Difficulties of temperature or purity of water are scarcely factors in carp culture. Providing the water is not too cold, carp thrive rapidly. In fact, no natural water has yet been found too warm for them. Being vegetable feeders, carp thrive on the plants growing in the water, or may be given offal, like pigs, or boiled grain, like chickens. A large pond may be dug on arable land, allowed to grow carp for two or three years, the fish marketed, and the ground be brought under culture again.

The profitableness of carp culture is shown by the following experience reported in a California paper. A gentleman in that State bought six carp in January, 1876. One of them soon died. From the other five he raised the first year 2,044 fish, and the year after 2,672. In 1878 he sold two of his old fish, and raised 4,000 from the remaining three. He had four shallow fish ponds, costing $50 each, and covering about half an acre of low ground comparatively worthless for other uses. For his original fish he paid $30, and $10 for food stuff, making a total outlay of $240. In four years he sold $415 dollars' worth of fish, and had from 4,000 to 6,000 left, after supplying his own table with fish for eighteen months.

There are thousands of small ponds throughout the country which might, with little trouble and large profit, be converted into carp ponds.

STOVE CASTINGS.

In a communication, too long to print, Mr. L. H. Bingham, of Harmor, Ohio, suggests several possible improvements in stove castings.

As a rule, he thinks too little metal is put into modern castings. He finds the lining of stoves not more than one-eighth of an inch in thickness, when three-eighths would be too little for durability. In one type of cooking stoves—a very pretty, convenient, and popular pattern—the fire divisions are not half thick enough to stand the heat, and the door frames are equally deficient in weight.

Mr. Bingham notes also that stoves with boiler attachments cannot be used for baking without having the boiler in place and full of water. To remedy this defect he proposes the insertion of a damper so constructed as to shut up closely between the boiler and the flues, and, when desired, to let down under the boiler, for the boiler to stand on when in.

Another suggestion is that stoves with boiler attachments be cast with a straight back, so that the boiler may be removed at pleasure, or used as a fruit drier. This, he thinks, could easily be done by casting the back of the stove straight, with the back wall in two parts, the upper section slipping in or out at will. By slightly modifying the present construction of such stoves and giving them a straight back, they can easily be made to take on any style of back attachments that may be cast for them.

MUYBRIDGE'S ZOOGYROSCOPE.

Our readers will recall the interesting illustrations of the motions of a trotting horse, drawn from Mr E. J. Muybridge's instantaneous photographs, which appeared in this paper, October 19, 1878. The suggestion then made that the motions of horses and other animals might be happily exhibited by an arrangement of such photographs in connection with a zootrope has been carried out; and, according to the San Francisco *Call*, of May 5, a private exhibition of the device had been given by Mr Muybridge in the gallery of the San Francisco Art Association. Mr. Muybridge calls his instrument a zoogyroscope. It is described as a circular glass having a series of photographs of the animal to be represented in motion, the photographs being successively illuminated by an oxyhydrogen lantern, as the glass is turned, throwing a single continuous yet ever-changing picture upon the screen.

While the separate photographs had shown the successive positions of a trotting or running horse in making a single stride, the zoogyroscope threw upon the screen apparently the living, moving animal. Nothing was wanting but the clatter of the hoofs upon the turf and an occasional breath of steam from the nostrils to make the spectator believe that he had before him genuine flesh and blood steeds. In the views of hurdle leaping the simulation was still more admirable, even to the motion of the tail as the animal gathered for the jump, the raising of his head, all were there. Views of an ox trotting, a wild bull on the charge, greyhounds and deer running, and birds flying in mid-air were shown, also athletes in various positions.

NEW YORK ACADEMY OF SCIENCES.

A meeting of the New York Academy of Sciences was held Monday evening, May 17, 1880, President Newberry in the chair.

Prof. Newberry exhibited a specimen of Hübnerite from Dakota. The tungsten in this mineral is replaced in part by manganese. Prof. Egleston remarked that the specimen was not so brown as Hübnerite from other localities, and that it probably contained less manganese. An analysis would reveal whether Hübnerite is really a distinct species.

A NEW PROCESS FOR PROTECTING GOODS FROM MOISTURE.

Prof. Kroeh exhibited some samples of delicately colored silks, velvets, and other fabrics that had been treated by a new process for the purpose of making them shed water. He showed that untreated portions of these goods were quickly wetted through when water was poured upon them, while the water rolled off in drops like globules of mercury from the treated portions. The inventor, Mr. D. M. Lamb, of New York, gives the name of Neptunite to the material by means of which this result is obtained. It appears to be some preparation of rubber dissolved in naphtha, but its accurate composition or the details of its preparation are not made public. It differs essentially from water proofing in that it does not fill up the pores and meshes of fabrics, but impregnates their fiber, leaving the air to circulate freely through them. Wearing materials of all kinds, such as silks, satins, velvets, woolen and cotton goods, kid gloves, ostrich feathers, furs, carpets, have been treated successfully without injury to the most delicate tints. Arnold's writing fluid, coffee, and claret have been spilt upon delicate silks so prepared and washed off again without leaving a trace. Ladies attired in such materials may brave the dampness and rain unscathed, and it is whispered that even their crimps may be made to keep their waviness by this means. It is claimed that the wearing qualities of goods are not only not injured but positively improved by the operation of rendering them water repellent. If this prove true, the company formed to introduce the process, under the presidency of the Hon. Hugh McCullough, is likely to reap a rich harvest; for no one will want to wear any other kind of goods. It is claimed, furthermore, that water repellent fabrics will neither shrink, mildew, decay, nor be attacked by moths. Time alone can show how well founded these claims are.

A communication from the council was read recommending to the Academy that the resignation of Dr. Martin be not accepted. A vote was taken, and the recommendation of the council was unanimously sustained.

Prof. Thomas Egleston then delivered an address

ON THE ORIGIN OF GOLD NUGGETS AND OF ALLUVIAL GOLD DEPOSITS.

Placer mines, in which gold nuggets are found, consist of alluvial deposits or ancient river beds. By far the greater portion of the gold in them is in a fine state of division. Near the surface the deposit is worth perhaps 30 or 40 cents per cubic yard, while further down it may reach a value as high as a dollar and a half. The commonly accepted explanation of the occurrence of nuggets in these places is that they were the result of the breaking down of auriferous quartz veins. This, Prof. Egleston maintained, could not be the case, because of their mammellar structure and chemical composition. Their structure is not such as would result from the transportation by water of the laminated gold of quartz veins. The latter, too, is often quite impure, being alloyed with silver, sometimes to the extent of 66 per cent, while the gold of nuggets is almost perfectly pure. In view of these considerations, and on the basis of the experiments directly to be described, Prof. Egleston proposed another explanation, declaring, as he said, with confidence, though not without expecting to be contradicted, that the gold in question was produced by deposition from solution. Gold, he said, had hitherto been considered by chemists as one of the most insoluble substances in nature, but in reality it is quite soluble. Sonnenstadt had shown that every ton of sea water contained 0·9 gramme of gold. This quantity is indeed extremely minute, but it must be remembered that nature is able to compensate for this minuteness by continuing her operations through thousands and millions of years.

The speaker's own experiments continued during the last five months show that gold is soluble at high temperatures and pressures in a variety of other solvents. Spongy gold exposed to the action of ammonium nitrate during that length of time imparted a distinctly yellow color to the solution. Faint traces were also found in solutions of bromide and iodide of potassium. Some of these solutions were exposed in sealed tubes to a temperature of 154°, and then to 214°. With solutions of sodium chloride and sodium carbonate no trace of gold was obtained. In another series of experiments 50 c.c. of water, containing about one-quarter gramme of gold, were exposed in vials, one with 1 c.c. of petroleum, and the others with one-half gramme of leather, leaves, and peat, and one-quarter gramme of cork. After five months the vial containing petroleum was found to contain upon the surface of the liquid minute crystals of gold, visible in strong sunlight. They are probably hexagonal prisms terminated by rhombic dodecahedra. The leather and cork were found to be entirely pseudomorphed. The action of the peat indicated that the presence of the organic acids of the soil favored the precipitation of the gold. Prof. Egleston believes that these and other experiments now going on in his laboratory warrant the conclusion that the gold of nuggets and alluvial deposits is due to chemical solutions filtering through the soil and precipitating their gold. This may account for the tradition prevalent among miners of the Carolinas and Virginia, that an abandoned placer left undisturbed for about twenty years, will yield a new crop of gold that may be even richer than the first.

Prof. Egleston concluded his address by describing some experiments on the nature of the so-called rustiness of certain kinds of gold, a property that prevents it from amalgamating readily. In deep placer mining the amount of gold actually obtained is only thirty three per cent of the amount shown by the assay. Hence the importance of investigating the causes of the loss. Gold heated and cooled slowly will amalgamate at once, if heated and cooled suddenly it will not. A momentary immersion into sulphureted hydrogen or ammonium hydrosulphide prevents amalgamation. To test the statement, that the presence of four thousandths of antimony prevented the amalgamation of Callao gold, he alloyed some gold with three or four per cent of antimony, but found that it would readily combine with mercury. He had also succeeded in dissolving out all the mercury from an amalgam, thus showing that it was not a definite compound.

The paper was discussed by Profs. Julian, Leeds, and Newberry. The latter asserted his belief that gold was doubtless extensively deposited from solution, but did not think nuggets were formed in this way. They are always found in connection with quartz veins, and do not differ essentially from them in composition. C. F. K.

MILK AND BUTTER PRESERVATIVES.

A high German authority in dairy matters, Dr De Kleuse, of Munich, says that the preserving compounds so widely advertised are nearly always composed of varying proportions of bicarbonate of soda, sometimes mixed with common salt, boracic acid, borax, mixtures of borax with common salt, salicylic acid, and of late a mixture containing half of boracic acid and half of sulphate of potassium. Bicarbonate of soda has been in use a long time, and is still largely used. It acts by neutralizing the lactic acid which is formed in the milk, but its action is not satisfactory, as it is liable to give the milk a soapy taste. Salicylic acid is also unsatisfactory as well as expensive. Boracic acid is a powerful antiseptic, and preferable to borax.

For dairy use Dr. De Kleuse finds the above-mentioned mixture of boracic acid and sulphate of potassium superior to all other preservatives, and perfectly harmless as well as cheap. It can be obtained at any druggist. Sixty grains to a gallon of milk or a pound of butter is sufficient to prevent souring or rancidity.

Electric Lights on Buoys.

The whistling buoys now in use weigh about fifteen tons each, and in their plunging, even during calm weather, a force of nearly three horse power is evolved. To utilize this waste energy Mr. Edison has devised a small dynamo machine to be carried by the buoy, the current from which will sustain an electric light equal to one gas jet. If successful, these self illuminating buoys must be of great use to mariners.

IMPROVED FOLDING MIRROR.

In the folding mirror shown in the annexed engraving four sets of mirrors are attached to a single support, which is adapted to revolve on the vertical standard. Each set of mirrors consists of a stationary mirror and three hinged mirrors, two of which are at the ends of the stationary one, the third being hinged to the top so as to swing in a vertical plane. This mirror is provided with a hook, by which it may be secured at an angle of about forty five degrees.

A person standing before this mirror will not only see a front view of the face, but will see side views in the lateral mirrors, and the upper mirror will reflect the image of the person foreshortened. Thus four different views may be had simultaneously. This invention is well adapted for use in the dressing room, and is especially useful in clothing and millinery shops or in other places where clothing is inspected or fitted.

Further information in regard to this invention may be obtained by addressing Mrs. C. McEvoy, P O Box 184, Millbury, Mass.

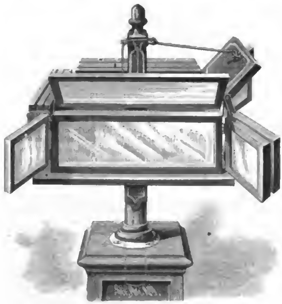
Improved Plan for Street Sprinkling.

At a recent meeting of the St. Louis Engineer Club, Col. Henry Flad explained a new device for sprinkling streets direct from the water works mains in a very rapid and efficient manner. The apparatus consists of three sections of four-inch wrought iron pipe connected between and at the ends with a hose and couplings, the pipe section being mounted on wheels for convenient transport. In connection with each section of pipe is arranged an automatic sprinkling nozzle, so adjustable that it can be readily adapted to any width of street. Half a block is sprinkled at a time, and ten blocks can be sprinkled in an hour. The connection being made with the waterworks mains insures a full head of water and very rapid and thorough work.

This system is specially intended for sprinkling residence streets at night. It will not answer at all for day sprinkling or for streets devoted to traffic. The estimated cost of this method is about one-tenth that of the present mode.

The Human Manufactory.

A man may eat and drink heartily all day, says an unknown writer, and sit and lounge about, doing nothing, in one sense of the word; but his body must keep hard at work all the time, or it will die. Suppose the stomach refused to work within ten minutes after a hearty dinner, the man would die in convulsions in a few hours; or cholera or cramp—colic would rack and wreck him. Supposing the pores of the skin—meaning thereby the glandular apparatus with which they are connected—should go on a "strike," he would in an hour be burning up with fever; oppression would weigh upon the system, and soon become insupportable. Suppose the liver became mulish, the appetite would be annihilated, food would be loathed, torturing pains would invade the small of the back, and the head would ache to bursting. Suppose the kidneys shut up shop, and danger most imminent, sufferings unbearable, and death more certain, would be the speedy and unenviable result. If the little workshops of the eye should close, in an hour he could not shut nor open them without physical force, and in another hour he would be blind; or if those of the tongue should close, it would become dry as a bone and stiff as steel. To keep such a complication of machinery in working order for a lifetime is a miracle of wisdom; but to work them by the pleasures of eating and drinking is a miracle of beneficence.



NOVEL FOLDING MIRROR.

EDISON'S NEW ELECTRICAL RAILWAY.

But for the chronic aptitude of this generation never to wonder at anything, we might expect to witness expressions of surprise as it becomes known that we are to be whisked through the country at the rate of thirty, forty, or fifty miles an hour by an agent invisible and unknown save by its effects; but the moment electricity is suggested as a motive power for railways, the never-to-be-surprised public say "Why not?" Nevertheless the practical application of the electric current to this purpose seems never to have had a prospect of success before the experiments of Dr. Siemens, in Berlin, in 1879, and the present extended experiments of Mr. Edison. It is a subject fraught with difficulties, and while it has always offered a seemingly promising field for inventors, the expense attending experiments of this class has been a most effectual barrier to progress.

Mr. Edison, more fortunate in this respect than many of our experimenters, has not been hampered by monetary difficulties, and having had ample means for carrying out his ideas in practice, he has been enabled to develop his inventions more rapidly perhaps than any other man living.

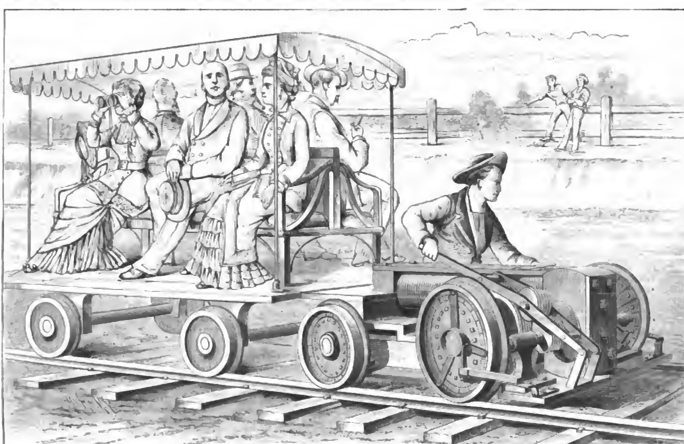
His new electric railway at Menlo Park is built over natural ground, with little or no grading, and with no regard for curves or grades. It is at present something over half a mile long, and is soon to be extended to form a mile circle. The present rolling stock consists of one electric locomotive and one open car. The general appearance of the railway and its equipments will be seen in our engraving. The motor is precisely like one of Mr Edison's electrical generators, figured and described in our columns some time since, and the motive power is supplied by his stationary engine, the power being converted into electrical energy by a single generator.

The current thus created is conveyed to the track by two copper wires, one wire being connected with each rail. The armature of the locomotive makes four revolutions to one of the drive wheels. The machine is managed about like a steam locomotive, and it pushes ahead with wonderful energy.

By invitation of Mr. Edison, representatives of this journal were present at a recent trial of this novel motor, and had the pleasure of riding, with some twelve or fourteen other passengers, at a break-neck rate up and down the grades, around sharp curves, over humps and bumps, at the rate of twenty five to thirty miles an hour. Our experiences were sufficient to enable us to see the desirableness of a little smoother road, and to convince us that there was no lack of power in the machine. Mr. Edison says that he realizes in the locomotive seventy per cent of the power applied to the generator. He will soon add four more cars, and apply improvements which he has in contemplation.

This grand experiment is designed to test the applicability of the electric current to this purpose, and to develop a railway system suitable for plantations, large farms, and for mining districts, and perhaps it is not entirely visionary to expect that our street and elevated railways may at no very distant day be successfully operated by electricity.

When the motor is complete and the road thoroughly equipped, we hope to be able to present our readers with further details.



EDISON'S ELECTRICAL RAILWAY.

SEEING BY ELECTRICITY.

The art of transmitting images by means of electric currents is now in about the same state of advancement that the art of transmitting speech by telephone had attained in 1876, and it remains to be seen whether it will develop as rapidly and successfully as the art of telephony. Professor Bell's announcement that he had filed at the Franklin Institute a sealed description of a method of "seeing by telegraph" brings to mind an invention for a similar purpose, submitted

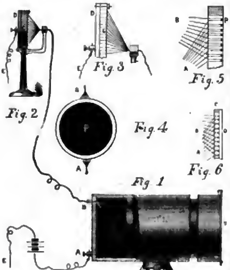


Plate 1

SELENIUM CAMERA.

to us some months since by the inventor, Mr Geo. R. Carey, of the Surveyor's Office, City Hall, Boston, Mass. By consent of Mr. Carey we present herewith engravings and descriptions of his wonderful instruments.

Figs. 1 and 2, Plate 1, are instruments for transmitting and recording at long distances, permanently or otherwise, by means of electricity, the picture of any object that may be projected by the lens of camera, Fig. 1, upon its disk, P. The operation of this device depends upon the changes in electrical conductivity produced by the action of light in the metalloid selenium. The disk, P, is drilled through perpendicularly to its face, with numerous small holes, each of which is filled partly or entirely with selenium, the selenium forming part of an electrical circuit.

The wires from the disk, P, are insulated and are wound into a cable after leaving binding screw, B. These wires pass through disk, C (Fig. 2), in the receiving instrument at a distant point, and are arranged in the same relative position as in disk, P (Fig. 1).

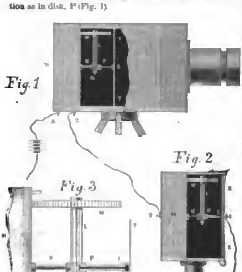


Plate 2.

INSTRUMENT FOR TRANSMITTING AND RECORDING IMAGES.

A chemically prepared paper is placed between disks, C and D, for the image of any object projected upon disk, P (Fig. 1), to be printed upon.

Fig. 3 is a sectional view of Fig. 2, showing wires and the chemically prepared paper.

Fig. 5 is a sectional view of disk, P (Fig. 1), showing selenium points and conducting wires.

Fig. 6 is a sectional view of another receiving instrument with platinum or carbon points, covered with a glass cap, there being a vacuum between glass cap, D, and insulating plate or disk, C.

These points are rendered incandescent by the passage of the electrical current, thereby giving a luminous image instead of printing the same. These platinum or carbon points are arranged relatively the same as the selenium points in Plate P (Figs. 1 and 4); each platinum or carbon point is connected with one of the wires from selenium point in disk, P (Fig. 1), and forms part of an electrical circuit.

The operation of the apparatus is as follows: If a white letter, A, upon a black ground be projected upon disk, P (Fig. 1), all parts of disk will be *dark*, excepting where the letter, A, is, when it will be light; and the selenium points in the light will allow the electric current to pass, and if the wires leading from disk, P (Fig. 1), are arranged in the same relative position when passing through disk, C (Fig. 2), the electricity will print upon the chemically prepared paper between C and D (Fig. 2), a copy of the letter, A, as projected upon disk, P (Fig. 1). By this means any object so projected and so transmitted will be reproduced in a manner similar to that by which the letter, A, was reproduced.

Figs. 1 and 2, Plate 2, are instruments for transmitting and recording by means of electricity the picture of any object that may be projected upon the glass plate at T T (Fig. 1), by the camera lens. The operation of these instruments depends upon the changes in electrical conductivity produced by the action of light on the metalloid selenium.

The clock-work revolves the shaft, K, causing the arm, L, and wheel, M, to describe a circle of revolution. The screw, N, being fastened firmly to wheel, M, turns as wheel, M, revolves on its axis, thus drawing the sliding piece, P, and selenium point, disk, or ring, B, towards the wheel, M—see Fig. 3. These two motions cause the point, disk, or ring, B, to describe a spiral line upon the glass, T T, thus passing over every part of the picture projected upon glass, T T.

The selenium point, disk, or ring will allow the electrical current to flow through it in proportion to the intensity of the lights and shades of the picture projected upon glass plate, T T.

The electric currents enter camera at A, and pass directly to the selenium point, disk, or ring, B; thence through the sliding piece, P, and shaft, K, by an insulated wire to binding screw, C (Fig. 1); from this screw by wire to binding screw, D (Fig. 2), through shaft, K, and sliding piece, P, to point, E (Fig. 2); then through the chemically prepared paper placed against the inner surface of the metallic plate, X X, by wire, F, to the ground, thus completing the circuit and leaving upon the above mentioned chemically prepared paper an image or permanent impression of any object projected upon the glass plate, T T, by the camera lens.

Fig. 2 is the receiving instrument, which has a clock movement similar to that of Fig. 1, with the exception of the metallic point, E, in place of the selenium point, disk, or ring (Fig. 1), at B.

Fig. 3 is an enlarged view of clock work and machinery shown in Figs. 1 and 2.

Oil in Allegany County, New York.

The Albany *Journal*, of April 22, reports that oil in paying quantities is being developed near Wellsville, in Allegany County, about forty miles to the northeast of what is known as the Bradford district in Pennsylvania. On Monday, April 19, an undoubted forty barrel well was struck at a point less than three miles from Wellsville. It is near the Triangle Well, which has been flowing moderately for two or three months, and about six miles from the Pennsylvania line. The event causes great excitement in that locality, as the fact is now placed beyond doubt that the Bradford belt, as it is called, extends indefinitely in a northeasterly direction into New York State. The region between Olean and Wellsville is now in fair way of being developed into first class oil territory.

NOVEL ANIMAL MOTOR.

Animals have always been used as a source of motive power, but the machinery for utilizing this power has generally been of such clumsy and imperfect construction that

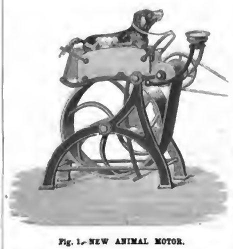


Fig. 1.—NEW ANIMAL MOTOR.

but a small percentage of the actual power was realized, besides making it extremely uncomfortable for an animal.

Mr. Richard, of Paris, has invented a very neat, practical and useful motor, which was exhibited at the last Agricultural Exhibition and at the Exhibition of Sciences Applied to Industries. The annexed cuts—for which we are indebted to *La Nature*—give a very good illustration of this novel motor. The animal, in this case a dog, is placed in a box or crib resting upon a shaft supporting the entire upper part of the machine. In Fig. 1 the animal is represented at rest, and the weight of the animal, maintaining its center of gravity, does not act upon the main driving wheel. But as soon as the box is in the position indicated by dotted lines in Fig. 2, that is, as soon as the tangent forms an acute angle with the vertical, the weight of the animal is sufficient to turn the wheel in the direction indicated by the arrows. The animal will naturally try to advance up the inclined surface, and will rotate the wheel by this action, as its weight continually acts upon the wheel. A fixed platform, E, is arranged below

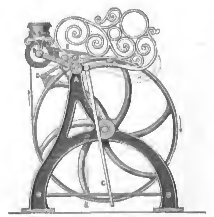
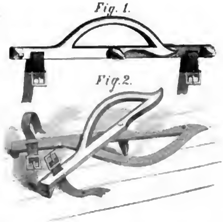


Fig. 2.—VERTICAL SECTION OF MOTOR.

at the side of the endless belt as a resting place for the animal, and a cup containing water is arranged in front of the box, so that the animal can drink while resting. Mr. Richard is a manufacturer of military uniforms, and runs a large number of sewing machines with his improved quadruped motor.

A NOVEL COMBINATION.

Americans are famous for making novel combinations, and it would seem that the last combination that would naturally suggest itself would be a shawl strap handle and a bootjack. Nevertheless we are able to present our readers with an engraving of an exceedingly simple and practical device that is peculiarly adapted to the double duty it is intended to perform. The device will be understood by reference to the engraving. Two similar castings are pivoted together, so that they may be arranged as shown in Fig. 1, when the device answers as a shawl strap handle. By turning the parts on these pivots, as shown in Fig. 2, the device forms a complete bootjack.



MARSDEN'S STRAP HANDLE AND BOOTJACK.

This novel combination is the invention of Mr. Mark W. Marsden, of Connersville, Pa.

New Brunswick Red Granite.

An inexhaustible supply of fine red granite, equal if not superior in quality to the famous "Scotch" granite of Aberdeen, exists in Charlotte County, New Brunswick. Several attempts to develop quarries have been made during the past decade, but, owing to lack of transportation facilities and other hinderances, they have generally resulted in failure. Latterly there has been a considerable revival of effort in the work of getting out and cutting the granite, and a still greater impetus is expected from the completion this summer of the railway from St. Johns to the frontier at St. Stephen and Calais, Maine.

MISCELLANEOUS INVENTIONS.

An improvement in the class of cheese cutters having a rotary table or platform and vertically-operating slicer or knife, has been patented by Mr. Walter R. Green, of Salt Lake, Utah Ter. The improvement consists in the construction and arrangement of parts whereby the rotating table or platform on which the cheese is placed is supported at the edge, instead of centrally, by means of a pivot, and thus rendered more firm and steady both when at rest and in motion.

Mr. Jacob G. Fletcher, of Washington, D. C., has patented for artists' use an improved canvas stretcher which shall have all the qualities experience has decided to be necessary or most desirable, and it consists in constructing the bars or pieces composing the stretcher proper with plain miter joints, which are opened by means of wedges, and in providing said bars with holes and grooves for the purpose of receiving the fastening device, which is constructed of metal and approximately U-shaped, and when applied to the stretcher frame is sunk or embedded in the wood flush with the surface thereof.

An improved handle for candlesticks, which may either be used for lifting the candlestick or for hanging the same up against the wall, has been patented by Mr. William Selkirk, of Galveston, Texas. It consists in forming the ordinary circular finger loop in one piece with an upward extension provided with a slot, which may be placed upon a nail on the wall.

Mr. Michael Poss, of Shelbyville, Ind., has patented a bill and letter file case provided with mechanism connecting with a treadle for operating the springs that press the papers being filed.

An improved commode, which is simple and convenient, has been patented by Mr. John Finsterer, of Philadelphia, Pa. It consists in the arrangement of arms attached to the lid of the commode in such a manner that when the lid is opened these arms rise with it and are secured automatically, so that the person that sits on the commode may rest comfortably and not be in danger of breaking the lid.

An improved grate for fireplaces has been patented by Mr. Joseph Bunford Samuel, of Philadelphia, Pa. The object of this invention is to furnish grates for fireplaces so constructed that the top bar of the grate may be adjusted to serve as andirons when a wood fire is to be used.

Messrs. James Skidmore, Joseph M. Liston, and Orestes Skidmore, of Charleston, Ill., have patented an improvement in hame tugs for connecting the hames with the traces in the ordinary form of harness. It consists in the peculiar construction and arrangement of the metal clip or plate in connection with the leather tug.

Mr. James O. Stanley, of New Hartford, Conn., has patented certain improvements in the thread boards and thread guides of spinning and twisting machines, whereby the thread guide can be adjusted so that the threads, when delivered from the rolls, will run through the guide centrally with the spindle tip, and thereby escape the usual stretching and breaking.

An improvement in spring vehicles, patented by Mr. William B. Thomas, of Elmira, N. Y., is designed to keep the back springs of a spring wagon under a slight strain when there is no load in the rear part of the wagon, to prevent the rattling and undue wear of the spring joints, and to cause the wagon to ride easier.

An improved ticket holder has been patented by Mr. Samuel Herzberg, of Pontiac, Ill. It is designed for holding the tickets on which are marked the sizes and other particulars of goods, such as pantaloons and other clothing.

Mr. Emile F. Espérandieu, of Nashville, Tenn., has invented a velocipede of the tricycle class which is adapted for carrying packages, merchandise, or any articles of light weight, and which may be propelled by working swinging treadles having springs that aid in moving them backward.

Mr. Lewis B. Morgan, of West Liberty, West Va., has patented an improvement in plow and cultivator handles, which consists in a construction and arrangement of parts, which cannot be clearly described without an engraving.

An improved implement or machine for running slight furrows in plowed land as marks for planting corn or other seed, or for crossing out land for planting an orchard, etc., has been patented by Mr. Washington Barron, of Summit Bridge, Del.

Mr. Archibald H. Kerr, of Midway, Texas, has patented a composition for whitewashing houses, walls, fences, outbuildings, etc., designed for great smoothness, brilliancy, and durability; and it consists in a compound of lime, whiting, plaster of Paris, glue, carbonate of soda, biborate of soda or borax, and sulphate of soda, in certain specific proportions.

Messrs. Ebenezer Fisher and John Watson, of Kincardine, Ontario, Canada, has patented an improved die for forging metallic horse collar frames. This die has been developed after a long series of experiments. With it the desired perfection of operation and result may be obtained with certainty and precision, and a collar frame produced having the desired form, proportions, and lines of curvature required for greatest strength and lightness combined.

Mr. John B. Fogt, of Anna, O., has patented an improvement in that class of riding rakes in which the wire teeth are attached to the axle and the driver's seat attached to the hinged thills or shafts, so that upon releasing a locking lever the rake will be dumped automatically by the weight of the driver.

An improved adjustable seat for mowers, reapers, wheeled horse hay rakes, and various other agricultural machines, for farm wagons and other vehicles, or for use in any other situation in which it may be applicable, has been patented by Messrs. Samuel Hedges, of Wheeling, and Lewis B. Morgan, of West Liberty, West Virginia. It is capable of oscillation or adjustment laterally on a fixed point of support, so that it may be kept in horizontal position despite the lateral inclination of the body of the machine or vehicle while passing along a hill side or other inclined surface.

Mr. Talbot C. Key, of White Sulphur Springs, Ga., has patented a portable hay and cotton press, an improvement in the class of portable presses which are mounted on wheels and thus adapted to be conveniently transported from one locality to another without requiring a separate vehicle therefor. The invention consists in hinging the press box to the beams of the truck, so that it can be laid down on its side, for the purpose of transportation, etc., and in the means for securing the press box in the vertical position when required for work.

Mr. David C. Williams, of Florence, Ala., has invented a fruit picker, which consists in a ring fixed on the end of the staff, and having wire fingers projecting from its top portion for the purpose of detaching fruit; also, a basket or fruit receptacle pivoted to and within said ring, so that when the picker is put in use the inclination of the staff or pole will cause the basket to tilt and one edge thereof to approach the wire fingers, which are holding and pulling the fruit, and hence when the latter falls it is sure to pass into the basket or receptacle.

What they Knew Four Thousand Years Ago.

The *Popular Science Monthly* for June publishes abstracts from the address of Chief Justice Daly before the Geographical Society, in which he says:

From one of these books, compiled after the manner of our modern encyclopedias, and the compilation of which is shown to have been made more than 2,000 years B.C., it has been ascertained, what has long been supposed, that Chaldea was the parent land of astronomy; for it is found, from this compilation and from other bricks, that the Babylonians catalogued the stars, and distinguished and named the constellations; that they arranged the twelve constellations that form our present zodiac to show the course of the sun's path in the heavens; divided time into weeks, months, and years; that they divided the week, as we now have it, into seven days, six being days of labor and the seventh a day of rest, to which they gave a name from which we have derived our word "sabbath," and which day, as a day of rest from all labor of every kind, they observed as rigorously as the Jew or the Puritan. The motion of the heavenly bodies and the phenomena of the weather were noted down, and a connection, as I have before stated, detected, as M. de Perville claims to have discovered, between the weather and the changes of the moon. They invented the sun dial to mark the movements of the heavenly bodies, the water clock to measure time, and they speak in this work of the spots on the sun, a fact they could only have known by the aid of telescopes, which it is supposed they possessed, from observations that they have noted down of the rising of Venus and the fact that Layard found a crystal lens in the ruins of Nineveh. These "bricks" contain an account of the Deluge, substantially the same as the narrative in the Bible, except that the names are different. They disclose that houses and land were then sold, leased, and mortgaged, that money was loaned at interest, and that the market gardeners, to use an American phrase, "worked on shares," that the farmer, when plowing with his oxen, beguiled his labor with short and homely songs, two of which have been found, and connect this very remote civilization with the usages of to-day.

More about the Iowa Meteor.

At the time of the fall of the Estherville Meteor, May 10, 1879, some boys, who were herding cattle near a lake five or six miles from where the larger fragments fell, reported that just after the passage of the great body over their heads they saw and heard a shower as of hailstones falling on the water near by. In April last, people began to pick up near the borders of that lake small pieces of meteor from the size of a pea to the weight of a pound. These soon found ready buyers at 25 cents per ounce by local traders. People left their farms—men, women, and children—and went out to the meteor ground, now freshly burned over, the belt being a strip of country commencing at or near Four Mile Lake, in the western part of Emmett County, and running southwesterly about eight miles, the width being from one-half to one mile. Upon this belt many thousands of small pieces were found. They are most generally metallic, very little stony matter about them, though some of the larger ones are of the same general appearance, and contain chrysolite in about the same relative proportion as in the larger masses. They are also, as a rule, very black, well crusted, and apparently perfect and independent bolides, not fractured particles from a large piece. The metal, cold, under a hammer flattens readily, is remarkably tenacious, and readily polishes, giving a peculiar steel-white or silver gray.

Mr. Charles P. Birge, of Keokuk, who furnishes these facts in a letter to the New York *Times*, estimates the weight of matter thus recovered at 75 lb., and thinks it highly probable that much of the iron hail penetrated the ground and water, and is thereby wholly lost. So the inference is fair that the total weight of the fall is greatly in excess of the 800 lb thus far recovered the larger masses weighing 437, 170, and 92¼ lb., and minor fragments about 50 lb.

A Ship Railway Wanted in Oregon.

The *Alta California* suggests that there is no better place on the continent for testing a ship railway than at the Cascades in Oregon, to transport laden steamboats past the lower rapids of the Columbia River. The rapids there are only six miles long; the grade of the road need not exceed 15 feet to the mile anywhere; the boats to be carried are not near so heavy as those that demand transportation at Panama, and a large traffic demands greatly increased facilities for passing the rapids.

Many thousand tons of wheat were detained in Eastern Washington through the winter because transportation was impossible. The president of the Astoria Chamber of Commerce, Mr. Bowlby, in a report made in January last said:

"Last season it cost $10.50 per ton to carry wheat from Walla Walla to Portland, and $11.50 to Astoria. Thirty miles of that distance is by rail, and cost $4.50 per ton, while the remainder, 235 miles to Portland, by boat, over two portages, cost only $6, and the 333 miles to Astoria, over the same portages, cost but $7 per ton.

"The Columbia River is the natural highway and outlet for the country drained by it, and unless navigated and improved that section of country will soon be choked by its own great growth. The portage road at the Cascades was run night and day from August till the upper rivers were closed with ice, and with great difficulty was it possible to keep the freight from being blocked. This portage, a distance of seven miles, with rolling stock, is maintained, and freight is taken from the boat on to the cars, and from the cars to the boat, provided the boats and cars await each other; otherwise, the grain is moved from the boat to the warehouse, and fourthly, to the boat below.

"We estimate the freight passing over the road at 1,000 tons per day for the past six months, which, counting 300 days in the year, would be 225,000 tons last year, which, at 50 cents per ton, cost the farmers of the upper country the sum of $112,500 for a portage ride of seven miles."

The federal government has announced the intention of constructing canals around the obstacles to commerce, and has begun work in a slow way at the Cascades. The *Alta* insists that it is the duty of Congress either to push the canals at both rapids, or to make a contract with Eads to authorize him to finish a ship railway this summer at the Cascades, with the intention of supplying the upper rapids at the Dalles in the same manner in 1881, if the experiment at the Cascades should be successful.

The ship railway has immense possibilities. It should be tried without delay; the idea is American in its origin, and its value should be tested here, and the best place and the best man for it are the Cascades and Eads.

Luminous Paint in Railway Cars.

The experiment of coating the interior of a railway carriage with Belmain's luminous paint has been tried in England with considerable success. The English *Railway News* says that a first-class carriage was chosen for the experiments, and in the daylight its appearance is very little, if any at all, different to ordinary paint, but during the time the carriage is exposed to the light the paint is rapidly absorbing the daylight, only to give forth the same the moment the carriage is traveling in the dark. At first the light emitted is only slight, not that the paint is any different in its illuminating powers, but the pupils of the eyes of the traveler have not yet been accustomed to the light, for, as the journey proceeds, the carriage appears to be completely lighted up, so much so that the passengers are enabled easily to recognize the features of their fellow travelers, while the time by a watch is clearly discernible.

It is thought that for trains running long journeys, with tunnels occasionally intervening, the paint will be very valuable, inasmuch as the oil and gas can be entirely abandoned, and the great waste at present experienced avoided. How the paint illumination would work on dark, cloudy days does not appear.

Butter, Eggs, and Cheese.

At the recent annual session of the National Butter, Egg, and Cheese Association at Indianapolis, Mayor Lord, of Elgin, Ill., read a paper on the milk industry. The magnitude of the industry was shown by reference to the fact that there are 13,000,000 milch cows in the country, requiring the annual product of 52,000,000 acres of land to feed them, and giving employment to 650,000 men. Estimating the cows at $30 each, the horses at $80, and land at $30 per acre, together with $200,000,000 for agricultural and dairy implements, and the total amount invested in the industry is $2,219,280,000. This is considerably more than the amount invested in banking and the commercial and manufacturing interests of the country, which is $1,800,964,586.

Effects of Heat on Granites.

Mr. Hiram A. Cutting, State Geologist, of Vermont, has been testing the capacity of different sorts of granite to withstand heat. He tested twenty two specimens of the best known quarries, and found that while all were unaffected by 500° Fah., damage usually began at 600°, was serious and frequent at 800°, and at 1,000° all the specimens were ruined, the stone from Mount Desert standing the test perhaps better than any other. He gives it as his opinion that the effect of water on heated granite is rather apparent than real.

AMERICAN INDUSTRIES.—No. 44.

THE MANUFACTURE OF WESTON'S DIFFERENTIAL PULLEY BLOCKS, SAFETY HOISTS, ETC.

The invention of the differential pulley block by Mr. T. A. Weston, some years ago, was the accomplishment of a radical improvement in one of the oldest mechanical appliances known to man. The ordinary tackle block, in more or less perfect form, is known to have been in use among the early Egyptians, and probably dates back to the earliest days of civilization. The device, like the art of sewing prior to the invention of the sewing machine, continued without essential change until Mr. Weston at a single stroke increased its efficiency thirty or forty fold, gave it its self-sustaining capacity, and added that quality of safety which gives to the differential block its greatest value. First introduced in England, the invention spread rapidly over the entire mechanical world, and has now long been recognized as an indispensable adjunct in mechanical operations of all kinds. Its greatest charm lies in its *absolute simplicity*, for it is the reduction of a mechanical problem to its simplest possible terms. To this fact may be attributed the extraordinarily rapid adoption of the device as soon as introduced, and the universal popularity and esteem in which it is held.

In the ordinary or "direct" style of block one man can lift from one thousand to two thousand pounds. By means of the recently added "geared" style of block the lifting capacity of each man is increased to from two thousand to five thousand pounds. With both styles the load is always self-sustained, and *cannot run down*. To effect lowering it is necessary to reverse the motion of the chains, by pulling on them, when the load will descend, but only so fast and so long as the chains are moved by hand. If at any time the chains be let go, either in hoisting or lowering, the load immediately comes to rest.

In the illustrations on the first page of this paper are shown the principal details of the manufacture, as well as some of the most important uses to which these hoisting devices are put. In the differential pulley, as is well known, the wheels in each block are made with sprockets, in which the links of an endless chain must lie smoothly and fit exactly. The chain passes around but one wheel in the lower block, but in the upper block are two wheels on the same shaft, one a small fraction larger than the other. In hoisting, the chain is taken up on the larger, and paid off from the smaller of these two wheels, while in lowering the reverse occurs, the effect on the load being due to the *difference* in the diameters of the wheels. This difference, as already stated, is very slight, and the differential effect that is obtained, therefore, gives the operator an immense leverage in handling the load. In making what is styled the "direct" differential pulley blocks, the loop in the chain which hangs loose and free from the upper pulley is used to pull upon in raising or lowering the load, and this loop is lengthened or shortened as the load goes up or down; but in the "geared" pulleys, which have been since introduced, an extra wheel is added to the upper block, from which an endless hand chain depends, the length of which does not change. By this simple addition to the "direct" differential pulley its power can be increased from three to five fold without making the blocks or apparatus any more cumbersome or complicated.

The prime essential in these pulleys, and the condition without which they would be worth little more than so much old iron, is to have the shape and pitch of the sprockets in the wheels exactly right, and then to make the chains so they will fit perfectly, without danger of stretching. When, therefore, the Yale Lock Manufacturing Company, about five years ago, purchased the patents of Thomas A. Weston on differential pulleys and other hoisting apparatus, they set themselves to making such improvements in the manufacture, and to the attainment of such exactness in workmanship as would leave nothing to be desired on this score. The company already had a wide reputation for the excellence of their locks, but in the new field they then commenced to work they achieved a success in every way commensurate with that they had won in the specialty with which they have been for so many years identified.

In our illustrations, the chain making, as shown to the left at the top of the page, is conducted in a blacksmith shop where are twenty-one forges. The chains for the differential pulleys are all made by hand, and Welsh and English workmen are found most competent in this specialty. They work very rapidly, each link of the chain being made of a piece of Norway rod iron cut off at an exact length, and made as true as it could be cut out with a die. In this department also is a steam hammer, and an apparatus especially designed by the company for bending the hooks for the wrought iron tackle blocks. These hooks are flattened a little to give them greater width through the point where the greatest strain comes, and it has been a matter of no little study and experiment with the company to determine exactly what shape was best for giving the greatest strength, so that the hook would not straighten out under the load, and in all parts, as well as with its joining with the block, the strength would be proportionate.

The machine shop, as shown in the other engraving at the top of the page, is fully fitted up with lathes, planing machines, etc., and all the requisite tools for finishing the various parts of the work, and in this department is also conducted the gauging of the chains and testing of the blocks, which are shown in separate views. The gauging of the chains is carried on according to a plan especially designed for this work, and every link of each length destined for use in the differential pulleys is here gauged. The links are first purposely made a little short of the length they are finally intended to be, the chain is then laid on a gauge which represents just the circumference of the sprocket wheel, and stretched until it fits exactly thereto. This is intended to take out all the "stretch" which would occur in use, and to give the links just the shape at which the chain will endure the greatest strain. The chains tested here include those for one eighth ton pulleys, made of three sixteenths inch iron, up to those for ten ton pulleys, made of seven eighths inch iron. The testing of the blocks, shown in the adjoining view, explains itself. no hoisting apparatus is ever sent from the shop until it has all been put together and tested as to its capacity to lift, without stretching, the entire load which it is built to carry.

The "Light Traveler," for warehouse use, showing how these pulleys can be arranged to run on overhead rails, affords a good illustration of the advantages which can be secured by such an arrangement in stores where goods are to be stored in quantities, and yet give such convenience of access that cases may be readily taken, for inspection or removal, from any part of a large warehouse.

In the "Hoisting Crab and Derrick Winch," shown in another view, the Weston patent brake is used, so that the load is always self-sustained, and the handles may be at any time suddenly "let go" without the weight "running down." To lower the load the handles must be turned backward, but unless this is done the suspended weight remains stationary.

In the jib and traveling cranes, shown at the bottom of the page, the further application of the principles of this patent hoisting machinery for the moving of heavier bodies is represented. All the several motions for moving the load are made by direct pull, and, while the appliances are so simple that nothing can possibly get out of order, there is absolute safety against the load running down except by the positive action of the workmen having it in charge.

THE OLD STYLE. THE WESTON.

In the illustrations on this page one will be at once recognized as an apt portrayal of the difference between the hoisting of heavy weights by these improved differential pulleys and the doing of the same work in the old fashioned way. In the other is shown what is called the "double lift," for hoisting or letting down expeditiously only moderately heavy loads. It is extensively used in stores and factories, and consists of a chain, with hook on each end, passing over a sheave which can be rotated by a hand rope and wheel. It is provided with Weston's patent brake, so that if the rope is let go the load will remain suspended and can never run down. As one hook ascends the other descends, and is thus ready for the next load, one man being able to lift a full load at the rate of about twelve feet per minute, and lighter loads proportionately faster, while the speed for lowering may be regulated as desired.

By the improvements which the Yale Lock Manufacturing Company have introduced in the manufacture of these various devices for hoisting and managing heavy loads they not only have greatly increased efficiency, but absolute safety, as against the cumbrous and dangerous methods heretofore used, and their differential pulley blocks, safety hoists, traveling and jib cranes, etc., are now meeting with constantly widening demand for use in machine shops, factories, forges, mills, steamships, as well as in laying street mains, pulling stumps of trees, and in fact to a diversity of uses which it would require a catalogue to enumerate.

The works of the company are located at Stamford, Conn., and they have salesrooms of their own at 53 Chambers street, New York; 36 Pearl street, Boston; 506 Commerce street, Philadelphia; and 64 Lake street, Chicago. Their goods, as above described, are largely handled by all dealers in machinery, engineers' supplies, etc., and the company will be happy to furnish, on application, an illustrated catalogue of the goods of their manufacture.

Correspondence.

Cotton Size and Cotton Sizing.

To the Editor of the Scientific American:

With reference to the article in the SCIENTIFIC AMERICAN of February 7th last, describing the English practice of over sizing cottons, and advising American manufacturers not to follow their example, I wish to bring to notice the fact that the people of this commercial part of the continent have begun to know that "not all that is white is cotton;" and it may be a surprise to the English manufacturers and traders to learn that the consumers now ask for American unbleached goods, in preference to the very white finished English cottons. The motive is this: practical experience has shown them that the former will become whiter after washing, and the weaving more compact, while the latter will be less white, the weaving more separated, and more than half of the weight of the goods will be lost in the first washing.

I am confident that this single yet forcible fact must be sufficient evidence in favor and encouragement of all kinds of honest manufacturing, whether in cottons or anything else.

The present fever for fraudulent adulterations, as now entered into by many of the manufacturers in England, in order to compete with cheap German and French manufactures, is simply ruinous to British commerce, and its evil effects will have to be borne directly or indirectly by the entire kingdom. To say that the cotton goods now introduced here from England are the same in quality to those of ten years ago, would be an absurdity. The English linen goods, which have stood unquestionably ahead of all others, are to-day so adulterated that some grades and trademarks, stamped "pure linen," "guaranteed all linen," etc., are, in fiber, half cotton, half linen, and in all cases heavily sized. But it is not only in all kinds of woven goods that England is suffering from great competition; in fancy goods and hardware she has a dangerous neighbor in the French Republic, which is in a good way to monopolize the trade of this country.

Adulterated manufactures will not last long anywhere to-day. People have time now to think, and a little to say in everything. Even the Indians in the vast Pampas readily know polished nickel from silver. Honesty and honest productions will, in the end, pay the best. In support of this assertion let us look at Messrs. Rogers & Son's cutlery. The steel used to-day in the different articles manufactured by this firm is as good if not better in quality than that furnished in their very first productions. For this and no other reason consumers here will pay two dollars gold for a Rogers & Son's three-blade penknife, and will not pay a half dollar for one of other makes, even should it have six blades.

Regarding art processes on the whole, one is led to believe that in England the idea still prevails that price is the primary and quality the secondary object with the consumer. In this case, I dare say, the adulterers will think it remarkably droll that the customer here should not pay better price for an article that furnishes him with more stuff.

In conclusion, let the Americans continue to manufacture honestly what they produce, disregarding other nations in the art of adulteration. The time will come when a common black cotton or linen necktie will bring a better price than a silk one, judging from the abominable black silks that are at present forced into public use.

P. DEL VALLE HALSEY.

Buenos Ayres, A. R., March 27, 1880.

Nerve Grafting.

Dr. J. Gluck, of Bucharest, lately brought before the ninth congress of the German Society of Surgery at Berlin some interesting results of experiments in nerve grafting. He cut out a portion of the sciatic nerve of a fowl, and then removed a similar portion of the same nerve from the leg of a rabbit, and placed this in the leg of the fowl, uniting the two ends by sutures. The nerve united, and the paralysis caused, of course, by the excision of the piece of nerve, was recovered from. He repeated the experiment, and exhibited the successful results, showing the fowls with full restoration of power. He was led to these experiments by the result of a case of nerve suture. Paralysis of the median had resulted from extensive destruction of the tissue of the arm by gangrene. Dr. Gluck cut down on the radial nerve and found that part of the nerve was destroyed. He united the two ends by sutures, and the man regained the power of motion, which he had entirely lost. Of course, the experiment in nerve grafting in animals, adds the *Lancet*, do not warrant the expectation that a similar result could be obtained in the case of the human subject. It is well known that the union and regeneration of nerves occur with greater facility in the case of the lower animals than in man.

Black Ants a Cure for Currant Worms.

A correspondent of the *Ohio Farmer* finds the common black ant an efficient protection against the plague of currant worms. He has several colonies of ants close to his currant bushes, and enjoys an abundance of currants, while his neighbors' bushes are overrun with worms. Formerly he took pains to destroy the ant colonies, but on witnessing their attacks upon the worms he has taken pains to protect and encourage them.

MECHANICAL INVENTIONS.

Mr. Thomas G. Glover, Jr., of Bedford, Ind., has patented a light running hand car that may be easily handled. It is designed for the use of section men and other employes of railroads.

Mr. George W. Dudley, of Waynesborough, Va., has patented a novel saw filing and setting machine, designed especially for saws having a straight row of teeth, and it comprises novel features which cannot be clearly described without engravings.

Mr. Charles S. Peach, of North Adams, Mass., has patented an improvement in ring spinning frames, the object of the invention being to prevent the threads from throwing out and interfering with each other, and to equalize the tension and draught on the thread, whereby the yarn will be wound on the bobbin equally hard and close at top and bottom.

Mr. Heinrich Seck, of Frankfort-on-the-Main, Germany, has patented a preparatory bolting machine so combined with a fine dressing machine that it serves for separating the husks, bran, and coarser particles from the meal, and for sorting the meal itself into different degrees of fineness at one operation.

Mr. Cyrus S. Stevens, of Lowell, Mass., has patented a machine for filing straight and circular saws. The invention consists in certain features of construction and combination for obtaining the necessary movements of the files and the requisite adjustments of the saws.

Mr. Alanson Cary, of New York city, has patented a machine for manufacturing metallic barbed ribbon for the wire used for fences so as to give to such a wire a barbed edge. The invention consists in a machine combining a reciprocating head carrying the cutters, a feed bed, and die plate, feeding rollers, and an intermittent feed motion, whereby the ribbon is fed forward beneath the cutters, and the operation performed rapidly without waste of material.

Messrs. John E. Best and William E. Higgins, of Arlington Heights, Ill., have patented an improved thill coupling jack for compressing the rubber in a thill coupling to allow the thill eye or coupling bolt to be readily inserted.

An improvement in machines for depositing fine and powdered substances in uniform quantities in packages, has been patented by Mr. James McCrodden, of New York city. The machines are so constructed that they may be readily adjusted for forming larger or smaller packages. They are convenient in operation, filling the packages quickly, and allowing them to be readily inserted and removed.

Mr. Winfield S. Reeve, of Riceville, Iowa, has patented an improvement in trimming shears for blacksmiths' use. The invention consists in connecting the cam lever with the movable jaw by a slotted plate, so that the operator may stand behind and over his work, thus being enabled to cut to a line.

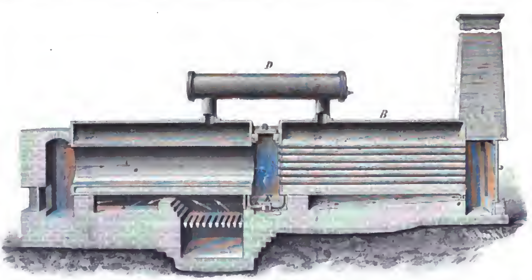
NEW STEAM BOILER.

Our engraving represents an improved compound steam boiler patented by Mr. Robert R. Hind, of Kohla, Hawaii, Hawaiian Islands. It is designed especially for utilizing cane trash or bagasse, or any other light fuel. These boilers have been largely introduced in the Hawaiian Islands, and have earned a reputation for being very economical steam generators, and exceedingly well adapted to any fuel supplying a long flame.

The boiler is composed of a single flue or Cornish boiler, A, and a multitubular boiler, B, placed end to end, leaving a space, C, between them. These boilers are connected together at the top by a steam drum, D, and at the bottom by circulating pipes, E.

The boiler, A, is set directly over the furnace with its forward end over the grate. The products of combustion and flame follow the direction indicated by the arrows, passing through the single flue of the boiler, A, across the space, C, and through the tubes of the boiler, B, to the chimney. A portion of the heated gas and flame is made to circulate under the boiler, B, before passing to the chimney. This boiler is highly spoken of by owners of sugar plantations in the Hawaiian Islands, and we have no doubt it might be profitably employed in saw mills, planing mills, and in manufactories relying on waste and on light fuel for generating steam.

The inventor would be pleased to correspond with any one desiring further information in relation to this boiler.



HIND'S COMPOUND STEAM BOILER.

IMPROVEMENT IN HATCHWAYS.

The annexed engraving shows an improved device for opening and closing hatchway covers or doors as the elevator approaches, passes through, and recedes from the floor either upon its ascent or descent. The engraving shows the elevator descending, and the doors being opened preparatory to the descent of the elevator through the floor. When the elevator ascends, the bows attached to the top open the covers, and they close gently by their own gravity after the elevator passes, the trip dogs employed in opening the doors acting as checks or counter weights; but when the elevator descends a more difficult problem is encountered, and it is this that the invention shown in the engraving is more particularly intended to meet.

IMPROVED HATCHWAY.

Upon one of the guide posts there are two guides, A B, for receiving vertically sliding trip-dogs, C, to which are attached ropes, D, connected with the covers, one being attached to each cover and running over pulleys, so that as the dogs are engaged by the elevator in its descent the covers will be raised. There are two inclined guides, projecting from the bottom of the elevator to insure the complete opening of the covers.

The trip dogs, C, have sufficient weight to nearly counterbalance the covers, so that but little force is required to operate the mechanism. As the elevator descends the trip dogs are pushed down until they are released at the lower ends of the guides, when the covers will be open and will be kept open by the elevator until it passes that floor, when they will follow the rounded bows at the top of the elevator and close automatically. The inventor informs us that architects and mechanics who have examined the invention pronounce it perfectly practicable. It may be placed upon any elevator without making any alterations in the hatchway.

The expense of the application of this device is very light. It makes no difference which way the doors are made to open, this mechanism will operate them. The frames in which the dogs work can be placed both on one of the elevator guide posts, one on each guide post, or on separate posts built especially for them. The working attachments are alike in size for all hatchways, thus making the cost very much less than where it is necessary to make the working parts of different sizes according to the size of the elevator.

The small wire cables or chains used in operating the covers is provided with a turn buckle to take up the slack in case they stretch. The whole contrivance is so simple that the engineer in charge of the elevator can always keep everything in perfect working order.

Hooks can be arranged to fasten the doors up, if necessary. This will not interfere in the least with the working of the elevator car. This is an advantage over other automatic hatch covers, because in some cases, when a door is broken or in any way out of order, the elevator cannot be worked until the damage is repaired.

For further particulars address the inventor and owner, W. H. K., 75 University Place, New York city.

Elevators.

We have in New York city several thousand elevators; they are used in almost every large and prominent establishment. In the post office building there are fourteen, and it is only a few weeks since that the principal one of these, as far as the knowledge of the public goes, and the one most used by the outside crowd, suddenly fell to pieces. It was a hydraulic elevator, the car being held upon a column of water. This was considered the best and safest of all, and yet the few persons in it at the time of the mishap barely escaped with their lives. Scarcely a month has elapsed since the accident at Fall River, by which Mr. Sevey was killed, and Mr. Crowley died since of his injuries. Since that time there have been eleven elevator accidents, and some one has been injured each time. What is still more alarming, all the elevators except two had safety appliances, and yet in every instance the car or cage fell to the bottom of the well.

Our city is famous for its cloud-seeking buildings. Ground is high, and story after story is added to make room for immense stocks of goods. Elevators duplicated and quadrupled afford easy access to the upper floors. This mode of conveyance is absolutely necessary, and cannot be dispensed with until some better method is discovered. It is idle to speak of safety appliances. We have had too many such catch-penny contrivances. We had a safety fire ladder some months ago by which two noble firemen were killed at the first experimental test in this city. What we need is something that will prove safe under all circumstances. What that will be we do not know, but our merchants who build warehouses a hundred feet high should interest themselves in providing for the absolute safety of the tens of thousands who daily use their elevators. Secretary Sherman, while in town last week, had a conversation with Postmaster James, when the latter urged the necessity of having more and better elevators in the post office building. The Secretary expressed himself heartily in favor of the pro-

posed improvement, and advised the postmaster to go before the Appropriation Committee at Washington with the Supervising Architect and present the need of an appropriation for this purpose.

The improvement is needed, and we hope the new elevators will be such as not to endanger human life. We have had enough of these man-traps.—*The Dry Goods Bulletin.*

[There is certainly ingenuity enough among our inventors to contrive some appliance which will render elevators absolutely safe. Who will do it?—EDS.]

SOUTH AFRICAN ANTELOPES.

The sassaby, or bastard hartebeest, as it is sometimes called, is by no means an uncommon animal, although some few years ago it was only known through the means of a mutilated skin.

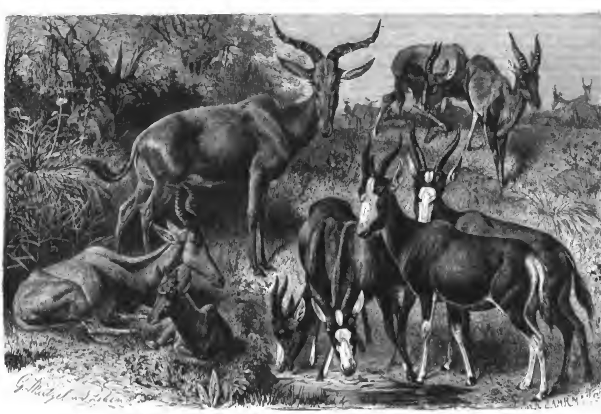
The general color of this animal is reddish-brown, the outer sides of the limbs being dark, and a blackish-brown stripe passing down the middle of the face. Sometimes the body is washed with a bluish-gray. It lives in small herds of six or ten, in the flat districts near the tropic of Capricorn, and is a most welcome sight to the wearied hunter when perishing with thirst. There are many antelopes which are almost independent of water, and can quench their thirst by means of the moist roots and bulbs on which they feed. But the sassaby is a thirsty animal, and needs to drink daily, so that whenever the hunter sees one of these animals he knows that water is at no great distance. It is rather persecuted by the hunters, as its flesh is in great esteem; but as it soon becomes shy and wary, it is not easily to be killed.

Concerning one of these animals, Cumming gives the following curious anecdote: "Having shot a sassaby as I watched the water, he immediately commenced choking from the blood, and his body became swelled in a most extraordinary manner; it continued swelling, with the animal still alive, until it literally resembled a fisherman's float, when the animal died of suffocation. It was not only his body that swelled in that extraordinary manner, but even his head, and legs down to his knees." The poor animal must have been shot through the lungs in such a manner that the air was forced by its efforts at respiration between the skin and flesh, until it assumed that puffy aspect.

The regularly lyrate horns of the bonte-bok, or nunni, serve to distinguish it from its congener the sassaby.

The color of the bonte-bok is a purplish red, the outside of the limbs deepening into a rich blackish brown, and contrasting strongly with the white hair which appears upon the face, the haunches, and front of the legs. From the vividly contrasting tints of the coat, it has derived the name of pied antelope, or white-faced antelope. The female is not so highly colored as the male, and the throat and under parts of the body are white. This animal is found in the district that borders the colony at the Cape of Good Hope, and lives in little herds of six or eight in number. Herds of much larger dimensions are said to be found in the more northern district. The height of the bonte-bok is nearly four feet at the shoulder, and its length is about six feet, being thus superior to the common stag in size. The horns are black in color, and are furnished with a series of ten or twelve half rings in their frontal surfaces. Their length is about fourteen or fifteen inches.

The bless-bok (*Damalis albifrons*) has sometimes been confounded with the bonte-bok; there is, however, a marked distinction in the color of the coat. The name, bless-bok, or blaze-buck, is given to this animal on account of the "blaze" of white upon the face, and is equally applicable to the bonte-bok.



Sassaby.—(*Damalis lunatus.*) Bonte-bok.—(*Damalis pygarga.*) Bless-bok.—(*Damalis albifrons.*)

SOUTH AFRICAN ANTELOPES.

The Sponge Fishery of Greece.

The sponge fishery, one of the most profitable occupations, is carried on round the island of Kalimnos by the Hydriots, Speziots, and Kranidiots, who have obtained the highest reputation as divers in this dangerous trade. They go in small boats to the places where the sponges are believed to grow upon the rocks, and then scatter over the sea surface a mixture of oil and fine sand. The sand, of course, sinks, but the oil forms as ever-spreading layer, through which can be seen, as clearly as in a mirror, the places where the sponges lie. The diver carries a large knife in his mouth, and fortified internally by a glass of schnapps, drops over the side, sinking himself by means of a large stone. At the sea bottom he cuts off all the sponges in reach and crams them into a bag, emerging in a short time with his booty. In recent years diving bells have been introduced, consisting of caoutchouc bags connected with the air by means of a pump.

When first obtained the sponges are enveloped in a gelatinous slime. To remove this they are spread on a sandy beach above high water mark, and covered with the sand brought by the tides. This was always the plan in former days. Now sponges are frequently bleached with sulphurous acid or chloride of lime, and sometimes even with potassium manganate and hydrochloric acid.

Thousands of dollars are annually brought to Greece by the sponge fishery.

The Culture of the Rose.

Among other most excellent articles in the June number of *Scribner's Monthly*, is the following on the propagation of roses, which is both timely and instructive:

Every rose will not come from the slip. Of the three great divisions into which the rose family is separated, viz., the damask, the noisette, and the tea, the last two may be propagated with more or less readiness from the slip, or by budding; the first only by dividing the roots, and planting the seed, which latter method is resorted to, however, only when it is desired to obtain new varieties.

The best season for taking rose slips is in June, just after the profuse bloom of early summer is over, although a person who knows exactly how to cut a slip may find good cuttings throughout the warm months. Judgment and discernment are needed for the selection at all seasons. I know a generous lady who sent her friends immense armfuls of boughs, with hardly a real cutting upon them.

One should choose from a good vigorous branch of last year's growth a fresh shoot, containing two or three buds, such as will always be found more or less swollen at the base of the leaf stems. It should be cut from the parent branch diagonally, with a smooth, clean cut that will bring off a little of the old bark as well, in order to make the condition as favorable as possible for the formation of roots.

Have ready a box or pot of rich mould. With a round, pointed stick, make a hole several inches deep, and fill it up with clean sand; insert the end of the slip in this sand to the depth of one or two inches; be sure to make it firm in the soil, and the sand acting as a percolator for moisture, you may keep your slip well watered. You can soon see, by the swelling of the buds and the dropping off of the old leaves, whether the slip is indeed taking root, but do not attempt to remove it to the place where you would wish it permanently to remain, until it has put out several sets of new leaves.

An ingenious way to raise a set of slips has been recommended by Mrs. Loudon, which we have tried with unvarying success. It is to take an earthenware flower pot, gallon size, and fill it more than half full of broken potsherds, pebbles, bits of slate, or such things; now set in the middle, on top of these refuse materials, another similar flower pot, half pint size, with the hole at its bottom stopped up tightly with a cork; let its mouth be even with that of the large, outer one; fill up the interstices with silver sand or other pure sand, and set in a row of slips all around, cut according to the directions given above. Keep the inner pot full of water all the time, but do not water the slips directly. In about six weeks your slips will have fine roots, and can be potted. A hand glass always hastens the process of rooting, and enables you to take advantage of the sunshine, but if you are not provided with one, be careful to keep your plants in the shade until they show certain signs of independence of life.

Roses need very rich soil to bring them to perfection, thriving best in a mixture of well rotted manure, sand, and garden loam, and to stint them of nourishment is indeed poor economy.

A Luminous Sea.

Last February the French ironclad L'Armide passed through a considerable stretch of milky or phosphorescent sea between Point de Galle and Aden. Lieutenant Pornain reports that the nights of February 9, 10, 12, and 13 were characterized by the phenomenon in all its splendor, the ship during this time traversing 660 miles (1,100 kilometers) in a mean latitude of 12° north, between the meridians of 61° and 51° east longitude. There was no thunderstorm, the sky was clear, the moon new, the barometer, thermometer, and hygrometer were regular, and a gentle northeast monsoon was blowing. The temperature of the surface of the water was constant at 25°. The sea was like a snow covered field in a clear night, and all traces of undulations were lost sight of. The milky look was hardly disturbed by the motion of the ship and working of the screw (which shows that the layer had considerable thickness). By day all disappeared; but the hue of the sea was somewhat

altered. Looked at attentively over the ship's side at night the water was seen to contain an enormous number of luminous particles pressed close together, and more brilliant close to the side (where disturbed). Some four hundred of these corpuscles, one to two centimeters long, could be counted in a bucket holding ten liters of the water. Drawn out, these were seen to be of gelatinous substance, which quickly dried and disappeared, leaving a dark globule one millimeter in diameter, which, in the microscope, presented a transparent ovoid animalcule, filled with eggs, and moving its fins and tentacles incessantly. A drop of water added to the dark globule brought back its luminosity; and when the creature was bruised in the hand, it gave a bright mark, which was quickly extinguished, and which had no smell. The milky water, kept till day and looked at in the dark, shows no luminosity, even though agitated; nor does the water procured by day and brought into darkness. It remains to be determined what causes the luminosity of those animalcula, and information is also desirable as to the position of the various milky seas on the globe, the times of their appearance, whether they persist in the same place or not, etc. Several of the officers on board the Armide had witnessed the phenomenon before, but never so brilliant or so continuous. The Armide, in going out, had passed thirty leagues further north in February, 1878, without encountering anything of the kind.

New Treatment for Cancer.

The *Lancet* calls attention to an important series of investigations conducted at the Queen's Hospital, Birmingham, as to a new method in the treatment of cancer, by Mr. John Clay, obstetric surgeon to the hospital, and professor of midwifery at Queen's College. Hitherto this terrible disease has proved incurable by medical treatment; but the inquiries and experiments conducted by Mr. Clay lead to the belief that by the use of Chian (or Cyprus) turpentine—which he has been the first to use—cancer can be not only arrested, but cured, without a surgical operation.

Mr. Clay's paper was published in the *Lancet* of March 27. He recommends his treatment especially in cases of cancer of the female generative organs. He says that he had made extended trial of various remedies, both general and local, but at last concluded that if cancer could be cured it must be by medicine administered internally, and must be of such a nature that it could be taken for a long time without affecting special functions or general nutrition. A study of the pathology of cancer led him to the opinion that a carbo-hydrate of some kind might prove beneficial, and for several reasons he decided that Chian turpentine might prove the most suitable. An opportunity was soon presented. A woman, aged 52, came to the hospital with cirrhous cancer of the cervix and body of the uterus. "Hemorrhage was excessive, pain of the back and abdomen agonizing, and cancerous cachexia well marked. The patient evidently had not a long time to live. In such a case it appeared to be justifiable to attempt to relieve the sufferings of the patient, even if the remedy should produce unfavorable symptoms, or should prove of no avail. I therefore prescribed Chian turpentine, six grains; flowers of sulphur, four grains; to be made into two pills, to be taken every four hours. No opiates were prescribed or lotion used. No change was to be made in her diet or occupation. On the fourth day after taking the medicine the patient reported herself greatly relieved from pain, and was in better spirits, but she complained of a large amount of discharge. It was feared that she referred to a discharge of a sanguineous nature. On examination, however, the vagina was found to be filled with a dirty-white secretion, so tenacious as to be capable of being pulled out rope-like, and this, although she had syringed herself three hours previously." The medicine was continued for twelve weeks with excellent results and every appearance of a cure being probable. At the end of that time she suddenly left the town and left no address.

The second case was a younger woman, aged 31. In this instance the cancer appeared to be melted away by the turpentine in four or five weeks.

Mr. Clay reports several other cases in which remarkable benefit evidently resulted, with every prospect of permanent cure. Some cases have been cancer of the breast, abdomen, etc. In a case where the turpentine could not be digested in pills, it was made into an emulsion by Mr. Whitfield, dispenser to the hospital, as follows: An ethereal solution of Chian turpentine was prepared by dissolving 1 oz. of the turpentine in 2 oz. of pure sulphuric ether (anæsthetic). The ether dissolved the turpentine instantly. Of this solution, ½ oz.; solution of tragacanth, 4 oz.; syrup, 1 oz.; flowers of sulphur, 40 grains; water to 16 oz.: 1 oz. three times daily.

Mr. Clay remarks that "ordinary oil of turpentine, if it produces any effect on cancer, is inadmissible on account of the speedy production of its specific effects, even when administered in small doses. The same remark applies with less force to the Venice and Strassburg turpentines; in my hands they have not produced the same beneficial effects on cancerous growths as the Chian turpentine has done. The maximum dose of the last named drug, which can be safely and continuously given, is twenty-five grains daily. It is advisable to discontinue the remedy for a few days after ten or twelve weeks' constant administration, and then to resume it as before. The combination with sulphur was given at first, and has been continued. It is doubtful whether much benefit is derived from the combination, but the effects have been so uniformly good with it, that it was thought advisable to continue its use. There is every reason to believe, from the trials made with other substances in combination with the turpentine, such as carbonate of lime, iodide of calcium, ammoniated copper, quinine, beberine, hydrastin, etc., that the turpentine is best administered simply, as the most marked and rapid effects have always been manifested when it has been given alone.

"The turpentine appears to act upon the periphery of the growth with great vigor, causing the speedy disappearance of what is usually termed the cancerous infiltration, and thereby arresting the further development of the tumor. It produces equally efficient results on the whole mass, seemingly destroying its vitality, but more slowly. It appears to dissolve all the cancer cells, leaving the vessel to become subsequently atrophied, and the firmer structures to gradually gain a comparatively normal condition.

"It is a most efficient anodyne, causing an entire cessation of pain in a few days, and far more effectually than any sedative that I have ever given. In the cases I have described no sedative was employed in any instance, although in some cases where great pain had existed previously to commencing the treatment, large doses had been given. Whether this arrest of pain arises from the death of the tumor, or, as my son suggests, is due to there being no longer irritation of the sentient nerves (in consequence of tension being withdrawn by the removal of the cells), the fact is the same."

How Ramuan Poison is Made.

In a letter to the *World* from the interior of Peru, Ernest Morris gives a minute description of the ingredients of the ramuau poison and the process of making it, as practiced among the Yajua and Tucuna Indians. These two little-known tribes prepare and supply all the poison used by Indians west of the river Japura in Brazil to the headwaters of the Maranon in Peru. This poison is sometimes called woorara; but the true woorara is prepared by the Indians of Guiana, chiefly from a species of strychnos, while in the preparation of the ramuau poison Mr. Morris is positive no strychnos is used.

During his stay with the Yajuas, Mr. Morris was permitted to accompany the Indians while collecting the plants and roots from which the poison is brewed; but his knowledge of botany is too limited to enable him to describe them scientifically. The following were used, the names being spelled as they are pronounced by the Yajuas.

No. 1. Ramuau.—This is the principal ingredient. It is a sepoy or climbing woody vine, varying from two to four inches in diameter, and is covered with a thin yellowish bark, which is exceedingly bitter to the taste. The leaves are very large, oblong, and deeply veined, and are of a light green color. The fruit and flower both unknown. Is a native of high land. The bark alone is used. No. 2. Wagana.—A large vine from four to six inches in diameter, with very small heart-shaped leaves, a native of low, flooded lands. It is very abundant. The roots alone are used. No. 3. Tuna.—A small tuberous plant with thick, glossy green leaves and beautifully variegated stalk, a native of low lands. The roots alone are used, and emit a very powerful and disagreeable odor, reminding one of asafœtida. No. 4. Rú-ámi.—A small bush with light green foliage, growing to a height of two feet, a native of low land. The bark and roots are both used, and are extremely bitter. No. 5. Cenn.—A very large bush with long, narrow-pointed leaves and very small white flowers, which are borne in clusters of three at the ends of branches. It is a native of high land, and is also bitter to the taste. The bark only is used. No. 6. Ne-wa-tu.—A small tree growing about twelve feet high. The trunk, which varies from two to five inches in diameter, is covered with a thin, light-green bark. The leaves are oblong and of a dark green. It is a native of high land. No. 7. No wu se; No. 8. Pupetu; No. 9. Ramre.—These are all small trees, the bark of which is used. No. 10. Mucutu, and No. 11, Newatu, are small shrubs. No. 12. Ramawe.—A bush attaining the height of three feet, with alternate fleshy, dark green leaves, which, upon being pressed, yield a whitish liquid, which, mixed with No. 9, gives to the poison that intensely bitter taste which it possesses when fresh. No. 13. Yellow peppers.

Many of the ingredients used in preparing this poison could, in Mr. Morris's opinion, be dispensed with. From four to six days are required to make one little pot, or two tablespoonfuls, of the ramuau. After the Indians have obtained a sufficient quantity of the plants and roots—and one would be astonished at the number they collect—they sit down on the floor, and both men and women carefully scrape the bark from the vine ramuau (No. 1), the principal ingredient. The bark is thrown into an earthen vessel, after which it is beaten and then pressed. It yields a whitish liquid, strong smelling and very bitter.

This liquid is put into a small earthen pot, conical in shape, and a great curiosity in itself, and suspended by a cord about eighteen inches above a slow fire. After a few hours Nos. 2 and 4 are added, after they have been treated in the same manner as No. 1. After the second day the mixture becomes almost black, and has the consistency of molasses. All this time it is very carefully watched by the Indians, who now and then taste it. Great attention is paid to the fire beneath the pot, for if the poison becomes the least scorched or burnt it is entirely worthless. After thirty-six hours No. 6 is added. During this time he had repeatedly tried the strength of the poison upon frogs. Grasping the animal by the hind leg he would, with a sharp pointed stick, insert the fresh poison into the foot, but without any effect. But when tuna (No. 3) was added, the poison became very black, and, upon tasting it, he found that even if it was not strong enough to kill the frog, it was strong enough to take all the skin off his tongue.

This was now left to simmer for about ten hours, when the Indians tried its strength upon frogs, which are the hardest animal to kill with this poison. A few moments after being pierced with the poisoned arrow the animal died—too quickly, my interpreter said. So the Indians added one ingredient after another, the last being the small yellow peppers. Again and again they experimented, and when the frogs made one or two hops and then died, the poison was pronounced complete.

The poison made by the Tucuna and Yajua Indians is put in little earthen pots, made expressly for it, and never in gourds. These pots are hidden in the damp woods, where the poison does not become hardened. Often the poison is so strong as to be almost worthless, as birds and game shot with arrows tipped with it prove unfit to eat, and in a few hours putrefy.

ENGINEERING INVENTIONS.

It is well known that the cause of smoke is that the fresh air, entering the incandescent coal from below through the grate, has often all its oxygen consumed before it has passed half way through the layer of coal, so that the upper part of the layer cannot burn, but is simply heated by the underlying incandescent coal, while the products of the combustion of the lower layer of burning coal pass through the upper heated and not-burning layer, and carry with them the combustible gases evolved by the heat, but which cannot take fire for the want of free oxygen. In order to furnish these combustible gases ascending through the upper layer of coal with the necessary oxygen to burn, Mr. Benjamin F. Sherman, of Ballston, Spa, N. Y., has devised a means of introducing air in the furnace with a downward injection upon the fire by a vertically adjustable arrangement of pipes, which may be placed close to the coals or further from them, according to the requirement of the case.

Mr. John U. Sumpter, of Lynchburg, Va., has patented an improvement in the class of axle journal lubricators whose action depends upon capillary attraction, the vehicle for conveying the lubricant to the journals being fibrous material, such as felt, tow, cotton, or fabric of some kind. This invention relates to the means for holding the fibrous material and supporting it in contact with a journal.

An improved railroad gate has been patented by Mr. Samuel L. P. Garrett, of Lewisburg, Tenn. The object of this invention is to provide a railroad gate that an approaching train will open by the pressure of the flanges of the wheels upon a horizontal bar fixed parallel with the rails and rising a little above them.

Theories of Light and Color.

A good deal regarding light was known to the ancients. They knew the law of reflection and something of that of refraction, as shown by the reference of Seneca to the broken appearance of an oar when thrust into the water. Another phenomenon, that of the rainbow standing out in the sky as a sort of challenge to the human eye, could not escape detection. At one particular angle, as shown by Descartes, beams reflected by or emerging from a drop of rain were so welded together as to form a condensed sheath of rays, and it was in this condensed sheath that you saw the colors of the rainbow. Milton, in 1672, proved by the use of the prism, acted on by a beam of light thrown through an aperture in a window shutter into a dark room, that white light is not homogenal, but is composed of various constituents more or less refrangible, of which red is the least and violet the most refrangible. This premised, Professor Tyndall, by a series of beautiful and interesting experiments from apparatus managed by his assistant, threw upon a white screen disks of several colors in order to prove the true effect of intermixture. Thus the ordinarily received theory that combination of yellow and blue produces green was shown to be erroneous, the true effect of the combination of those two colors being, as proved to ocular demonstration, white. By the same means the true complementary colors were displayed. Fixing the eye on a white disk until the lecturer counted twenty and the special illumination of the disk was withdrawn, the spectator saw remaining the filmy semblance of the complementary color, black. Blue left orange, red left green.—*Professor Tyndall at the Royal Institution.*

What We Think with.

Without phosphorus, no thought. So declared a famous German physiological chemist, some years ago. That particular brain substance, which he supposed to be essential to thought, has heretofore been known as protogen with phosphoric acid. Considering this name not sufficiently clear and definite, another German chemist has proposed for it the following precise and significant combination of seventy-two letters: Oxaethyltrimethylammoniumoxydhydratcleylopal methyloglycerinphosphorsäure. If mental derangement is in any way due to deficiency in the elements of this highly complicated compound, or to any snarling of its multitudinous constituents, the wonder is that anybody can ever think straight. And what a lot of it that German must have had in his head when he contrived such a name for it!

Manufacture of Antique Plate.

According to the London *Industrial Guardian* the manufacture of pseudo-antique articles in bronze, china, and plate is carried to a greater extent than most people are aware of. It is no exaggeration to say that this stuff is manufactured and sold in tons. The ways in which the public is imposed upon and the government, in many cases, defrauded by those who manufacture and vend it are various. First, there is what may be called the "hereditary plate trick." This plan is to get up articles after the antique, and to engrave upon them a fictitious inscription, as *e.g.*, "Presented by Lord A—— to his esteemed friend the Earl of B——, on his coming of age, A.D. 1750." The next step taken by some ingenious swindler is to write to some descendant of Lord A——, or of the Earl of B——, informing him that Mr. —— has obtained possession of an interesting *relique* of his distinguished ancestor, and to suggest the advantage of his lordship keeping it in the family. Then there is what may be styled the "ordinary trick" of the trade The method here lacks the invention of the other, but it is sufficiently ingenious for the gulls for whom it is intended. The dealer purchases some ancient article, say a saltcellar, worth about £1 sterling. He then takes this to some needy and unscrupulous silversmith, and induces him to clip the Hallmark from this genuine article and to solder or affix it to the bottom of some spurious article of a much larger size. Sometimes the silver of the latter is of a much inferior quality to that of the former, but not always. The article is then displayed in the dealer's window, with a well-devised advertisement, and sold as a genuine antique at a fancy price.

The "spoon trick" is probably the most lucrative method of swindling the public known to the *pseudo*-antique artificer, and at the same time the most difficult to detect. It is managed as follows: The dealer purchases some old spoons, and, cutting off the shanks, beats the portion on either side of the Hallmark out thin, and then incorporates it with some vessel of inferior workmanship; or, cutting out the mark only, solders it into the "wire" running along the base of a cup or vase. This can be done by an ordinary workman so neatly as to defy detection by any but an expert. In all of these instances it will be observed that a genuine mark is used, the imposture consisting solely of fixing the antique stamp to a modern vessel, and thereby inducing the unwary customer to pay an exorbitant sum for the article. But there are members of the fraternity of knaves who descend to a deeper depth of rascality. Probably they do not see the advantage of being nice in iniquity. At all events they do not scruple to forge the Hallmark as well as the age of the article which they sell. This is easily accomplished with the aid of Chaffers' book of Hallmarks, which was originally intended as a shield to honest dealers, but which has become a two-edged sword in the hands of knaves. To give the article thus stamped with forgery an antique appearance, the dealer oxidizes it with sulphur fumes, and sells it for twice or twenty times its value. Lastly, there is the "foreign plate trick." This consists of manufacturing articles in imitation of German, Dutch, and other foreign productions, and marking them as if they were such. The dealer by this means robs the government of the duty of 1s. 6d. an ounce which he would otherwise have to pay, and in many instances obtains the price of genuine silver for a composition little better than nickel.

We suspect that a great majority of the antique *treasures* are of the above class which American travelers bring home from abroad, which were obtained through the special influence of some newly made acquaintance, or the self-sacrificing dealer who had always desired the special article should go to America; he assuring the purchaser that the round sum demanded was of minor consideration compared with the fact of the relic going to the States.

And it seems almost a pity to have the delusion expelled by an exposure of the tricks of the modern artificer, thus rendering the possessor of the supposed to be veritable antique suspicious of the genuineness of his treasure.

A Rising Industrial City.

Among the rapidly growing manufacturing towns of Connecticut few if any are making more substantial progress or enjoy brighter prospects of future development than Birmingham, at the junction of the Housatonic and Naugatuck rivers, ten miles west of New Haven.

The census of 1870 found in Birmingham a population of 2,103. To-day, in spite of the general industrial depression of recent years, the towo boasts of 10,000 inhabitants within a radius of two miles. There are ten important manufacturing establishments on the power of the Ousatonic Water Power Company, and as many more, within the limits of the town, on the power of the Birmingham Water Power Company. There are churches of all denominations, excellent schools, a bank with $300,000 capital, a savings bank with over $1,000,000 deposit, gas and water works, telegraphic facilities, two lines of railway, abundant water communication by way of the Housatonic and the Sound, and all the other advantages for business and residence characteristic of a thriving New England town. Much of its rapid growth is primarily due to the enterprise of the Ousatonic Water Power Company, of which D. S. Brinsmade is secretary, in developing the natural advantages of the place in connection with its superior water power. By means of a dam of solid masonry, 22 feet high and 800 feet long across the Housatonic River, the largest and most reliable water power in the State was brought under control ten years ago, and the foundation laid for a large and prosperous industrial city. For after all that may be said of steam power—especially when coal is cheap, as it has been during the recent depression in the coal trade, or when steam power is taken in comparison with unreliable water power—the advantages of a reliable water power like that at Birmingham are incontestable. It is abundant, constant, and cheap, and costs per horse power only about one-third the average for steam power in New England. The Ousatonic Company own a large amount of real estate in the immediate vicinity of their works, providing ample room for mills and for the dwellings of operatives; also lots more remote, admirably adapted for first-class residences; all offered on such liberal terms to desirable parties that it is safe to predict for Birmingham a rate of growth in the immediate future as much more rapid than that of the past decade as the general prosperity of the manufactures of the country promises to be greater.

In addition to the attractions already enumerated Birmingham is favored by close and speedy connection with New York by rail and by water. Two lines of competing railways and a good water route insure reasonable freight rates; and the nearness of the town to the other manufacturing centers in the Naugatuck Valley removes any fears as to the supply of skilled labor. The town is also happily situated on the score of general healthfulness, and the surrounding scenery is fine.

To Distinguish Dyes in Colored Goods.

It is often necessary to know with what coloring matters a pattern has been dyed. In some cases an experienced dyer can soon ascertain, almost at a glance, or by simple methods, which dyestuff has been employed; but with many colors this is sometimes impossible. Especially is this the case with blue dyed fabrics, in which it is not easy to say whether a pattern has been dyed with vat indigo alone, or has been topped with cheaper stuff.

This detection can be made by a chemical analysis, the method consisting in destroying one of the coloring matters by some reagent, and thus prove its existence by the use of the destroying medium. To ascertain which mordant has been used, it is only necessary to burn a certain quantity of the fabric, and to find out by chemical analysis which oxide was present on the fabric. These methods are, however, only of use to chemists; but the following is a simple method that may be employed by anybody to determine the coloring matter. To begin with blue dyed fabrics. *Vat blue*, in the first place, is neither affected by alkalies nor acids (with the exception of nitric acid). Only chlorine and chlorine compounds react on vat blue.

A blue dyed with *sulphate*, or *extract*, or *carmine of indigo*, is readily abstracted by boiling water, and even more so by caustic alkalies.

Prussian blue is easily recognized by using alkalies which destroy it, while chlorine and acids have no effect upon it. However, the alkaline chlorine compounds of commerce (bleaching powder, etc.) react upon it.

Goods dyed with *logwood* give, with acids, a coloration more or less yellowish. In case there is another color associated with logwood, the latter may be extracted with a large quantity of acid. The fabric is then well washed, and the remaining color examined.

The red colors are more difficult to determine; but these colors have not the same importance as the blues.

Colors dyed with *cochineal* and *Brazil wood* (which, however, every dyer can easily distinguish) become gooseberry red when treated with muriatic acid. If it is washed, and then passed through milk of lime, a pretty loose violet is obtained. *Madder red*, treated exactly in the same way, and after the milk of lime bath boiled with soap, acquires a more intense color.

Cochineal red and *Brazil wood red* can be easily distinguished by means of oxalic acid, cochineal red becoming brighter, while the other is more or less destroyed.

Black, which is generally dyed by two methods, either with iron or chrome, when treated with chlorine, is destroyed if dyed with iron; but, if a chrome black, resists to a certain extent, only becoming chestnut brown, even with strong treatment.

To distinguish other colors there are many methods, which are, however, too complicated to be mentioned here. Aniline colors require greater chemical knowledge to distinguish them from each other.

Quenching a Fire in a Coal Mine.

"Anthracite," writing to the *Tribune* from Wilkesbarre, Pa., gives an interesting account of the means lately employed in quenching the fire in the Stanton shaft at that place. The fire begun with the burning of the breaker on the night of May 3, 1879. The shaft, 840 feet deep, was filled with water, and when it was pumped out it was found that there was still fire in a part of the mine (a slope up from the bottom of the shaft, about 500 feet in length and 200 feet vertical height), from which the water had been kept by the inclosed air, which had no means of escape.

The fire was burning so briskly that they were compelled to let the shaft fill with water again to prevent the entire mine from getting on fire. To get the water to rise into the A shaped apex of the coal measures where the fire was, they employed Mr. John Muirhead, of Wilkesbarre, to drill a hole six inches in diameter to strike the burning gangway at the highest point to let the air out, so that the water would rise and fill the cavity.

At the depth of 662 feet he found indications of the internal fire, and the borings came up very hot. At 667 feet his drills got fast in the heated rock and coal, for, instead of coming out in the gangway, he was in the solid coal at one side of it. His method of getting his drill loose was rather novel. After all the known methods had failed he had 670 feet of inch pipe, weighing 1,006 pounds, attached to the beam of his drilling machine, and connecting the pipe with a powerful pump he forced a stream of water through the pipe at a pressure of 200 pounds to the square inch. The end of the pipe was fitted with a circular steel bit, and by working the drilling apparatus he succeeded in removing the obstruction and getting his drill out, after drilling to the bottom of the vein—685 feet. The air could not escape; so to remove the partition of coal between the gangway and the hole, they put down a cartridge of giant powder 10 feet long, charged with 100 pounds of giant powder, and fired it with a battery. The powder had only about 30 per cent glycerine, and did not prove strong enough to burst the barrier. Then they put in a larger charge of 80 per cent glycerine and burst the coal out at the bottom. The water filled the hole within 50 feet of the top.

The main interest in this experiment will be reached after the water is pumped out and they have seen what the effect of a large charge of nitro-glycerine has been at that great depth and under the great pressure of over 600 feet of water. Torpedoes are used in oil wells, but the exact effect is not known.

Care Needed in Canning Fruit.

Recently four members of a Brooklyn family were taken violently sick after eating canned cherries. The poisoning was found to be due to a salt of zinc formed by the action of the free acid of the fruit on the zinc screw cover of the jar. In his report the chemist said:

"The presence of a zinc compound in the sirup was unmistakable, and it appeared in such abundance that some lack of precaution in preparing the fruit seemed probable. I learned, however, upon inquiry that the preserving had been done with scrupulous care by a friend of the family. Moreover, the contents of other jars of the collection prepared at the same time had been eaten without unpleasant results. As the jars yet unopened were placed at my disposal through the politeness of Mr. Gilbert [whose family had been poisoned], I selected one having a zinc top with a porcelain lining. There was no indication of zinc in the contents of this jar. I then poured about a fluid ounce of the sirup of this jar into the cover of the first jar and warmed it over a water bath for three quarters of an hour. The solution then yielded promptly to the test for zinc. . . . The case is not without parallel, but it is not sufficiently well known to the public that zinc yields so readily to the action of fruit acids, and consequently that the use of zinc or galvanized iron in the preparation or preservation of canned fruits is not free from danger."

Where the Colors Came From.

A Detroit man received from Japan a couple of Japanese hand-made illustrated books. The illustrations were finely colored. The Detroiter was particularly struck with the brilliancy of two of the colors. He saw that the Japanese had evidently some secrets in the color line that were worth having, so he wrote to his friend in Japan to see the book makers, and if possible find out where they got their colors and purchase some to send to Detroit. Yesterday, says the *Free Press*, an answer came from Japan. The gentleman there found where the colors were sold, and on making inquiry at the paint shop, he found that one of the colors came from Basle, Switzerland, while the other came from America.

Polar Shoes.

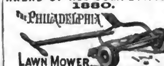
A Philadelphia firm are making fifty pairs of shoes for the members of Captain Howgate's Polar Expedition. Each pair weighs about five pounds, and are large enough to allow the wearer to protect his feet with three or four pairs of thick stockings. The soles are three-fourths of an inch thick, and between the inner and outer soles are layers of cork The uppers are thick black Arctic beaver cloth, lined with lamb's wool, with a layer of bladder between.

The Birth Rate in France.

The *Continental Gazette* notes that the birth rate in France is steadily diminishing; so is that of marriage, but in a lesser degree, the number of children resulting from these marriages having greatly declined. In the class composed of petty tradesmen or the well to-do peasants there is seldom more than one child per marriage, and it is stated that in one of the royal communes in Picardy the number of children among the best-off of the peasants is thirty-seven for thirty-five families. What, asks the *Gazette*, is to be the ultimate destiny of France if this decline of the population continues?

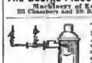
Pita—A New Fiber Plant.

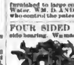
The American Consul at Vera Cruz has been calling attention to a new fiber plant, a species of cactus commonly called "pita," which promises to add materially to the resources of Mexico. Some of the fibers are sixteen feet long. The fiber is strong and silky, and capable of minute subdivision. Some months ago a native of Vera Cruz sent some of the fiber to England, where it was woven into handkerchiefs, which were strong and extremely beautiful, appearing more like silver tissue than like linen. The plant grows wild, and there are millions of acres of it.



The PHILADELPHIA
LAWN MOWER.

BRADLEY'S CUSHIONED HELVE HAMMER





PATENTS

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

ROOFING AND LINING FELTS.

A durable and economical roofing material furnished for $2.75 per square (10x10). Waterproof Sheathing Paper for lining houses, depots, etc., 2 cents per square (10x10). Send for samples and circular. R. H. MARTIN & CO. P. O. Box 2250. 70 Maiden Lane & 9 Liberty St., N. Y. City.

Pictet Artificial Ice Co., Limited,

P. O. Box [illegible]. 142 Greenwich St., New York. Guaranteed to be the most efficient and economical of all existing Ice and Cold Air Machines.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular. WM. SELLERS & CO., Phila.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, Try Street, 2d and 3d Avenues, Pittsburg, Pa. 190 S. Canal Street, Chicago, Ill. Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass. Geo. Place Machinery Agency, 121 Chambers St., N. Y.

H. W. JOHNS' ASBESTOS Liquid Paints.

These are the purest, finest, richest, and most durable paints ever made for structural purposes. They are prepared ready for the brush in sixteen newest shades and standard colors, suitable for the tasteful decoration of dwellings and all classes of buildings, inside and out, and for all purposes where a perfect protective coating is required, and covering body and durability considered, they are *twenty-five per cent cheaper than the best White Lead or any other kind of paint now in use.*

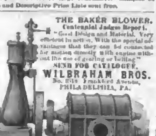
Be Sure and Get the GENUINE, *Which Are Manufactured Only by*

H. W. JOHNS M'F'G CO.,
87 Maiden Lane, New York.

Sole Manufacturers of Genuine Asbestos Roofing, Boiler Coverings, Sheathings, etc.

Special Prices to large consumers. Samples of Colors and Descriptive Price Lists sent free.

THE BAKER BLOWER.



Centennial Judges Report. "Good Design and Material. Very efficient in action. With the special advantages that they can be connected for motion directly with engine without the use of gearing or belting." SEND FOR CATALOGUE. WILBRAHAM BROS. No. 2318 Frankford Avenue, PHILADELPHIA, PA.

New Undestructible Water Pipe.

We are now prepared to furnish Water Pipe from 1 in. upward. Cost less than cast-iron pipe. Will not rust or corrode. Guaranteed 300 pounds pressure to the square inch. Apply WROUGHT IRON ASPHALTED PIPE CO. FACTORY, 300 East 112th St., New York City.

GIVEN AWAY!!

FLOWER SEEDS for the WILD GARDEN, sufficient to sow a bed a rod square, given free to every subscriber to

THE AMERICAN GARDEN,

an illustrated quarterly devoted exclusively to gardening. Only 25 cents per year, postage prepaid. B. K. BLISS & SONS, 34 Barclay St., New York.

THE HOLLY SYSTEM OF STEAM HEATING [illegible] LOCKPORT N. Y.

PAINTERS, Address for catalogue new mode of graining. J. J. Callow, Cleveland, O.

WOODSTOCK, ONTARIO, for many branches of manufactures, offers greater facilities than almost any town in Canada, and should be visited by those wishing either to commence or extend their business. Address THE PRESIDENT OF THE BOARD OF TRADE.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing, specially adapted to Flour Mills. Send for catalogue. J. T. NOYE & SONS, Buffalo, N. Y.

THE MACKINNON PEN OR FLUID PENCIL.

Particulars mailed Free. MACKINNON PEN CO., 200 Broadway, near Fulton St., N.Y.

The New York Ice Machine Company,

21 Courtlandt Street, Room 54.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more ice. Uses only ½ water of condensation. No Pressure at rest. Pressure in running, 25 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

DOUBLE PITMAN PRESSES. STILES & PARKER PRESS CO., Middletown, Ct.

COLUMBIA BICYCLE.

A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of The Bicycling World. THE POPE M'F'G CO., 89 Summer Street, Boston, Mass.

WM. A. HARRIS, PROVIDENCE, R. I. (PARK STREET), Six minutes walk West from station. Original and Only builder of the

HARRIS-CORLISS ENGINE

With Harris' Patented Improvements, from 10 to 1,000 H. P.

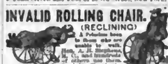
BOILER COVERINGS.

Plastic Cement and Hair Felt, with or without the Patent "AIR SPACE" Method.

ASBESTOS MATERIALS,

Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John Street, and Foot of E. 9th Street, New York.

INVALID ROLLING CHAIR. (RECLINING)



A Priceless boon to those who are unable to walk. Hon. A. H. Stephens, M. C., and hundreds of others use them. Send for Circular to FOLDING CHAIR CO., New Haven, Conn.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

TELEGRAPH and Electrical Supplies. Send for Catalogue. C. E. JONES & BRO., CINCINNATI, O.

WOOD SOLE SHOES.

The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send stamp for circular and price list. CHAS. W. COPELAND, 122 Summer St., Boston, Mass.

BUY NO BOOTS OR SHOES Unless the soles are protected by Goodrich's Hammer Steel Rivets. Guaranteed [illegible] any other sole. All dealers sell them. [illegible] for 25 cents in stamps. Send paper pattern [illegible] wanted. H. C. GOODRICH, 19 Church St., Worcester, Mass.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

The Rodier Patent Single Iron Plane.

Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and stands any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

GENUINE BABBITT METAL,

Fine Brass and Composition Castings. E. STEBBINS M'F'G CO., SPRINGFIELD, MASS.

MICROSCOPES and every description of Optical Instruments, the best and the cheapest. Send for Illustrated Priced Catalogues. R. & J. BECK, Manufacturing Opticians, Philadelphia, Pa.

J. STEVENS & CO.,

P. O. Box 28, Chicopee Falls, Mass. Manufacturers of Stevens' Patent Breech-Loading Sporting and Hunters' Pet Rifles, Single and Double Barrel Shot Guns, Pocket Rifles, Pocket Shot Guns, Gallery Rifles, Superior Spring Calipers and Dividers, including the New Patent Coil Spring Calipers, also Double Lip Countersinks and Hathaways' Patent Combination Gauge.

THE TANITE CO., STROUDSBURG, PA.

EMERY WHEELS AND GRINDERS.

LONDON—Bed Andrews St., Holborn Viaduct, E. C. LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES AND AIR COMPRESSORS

MANUFACTURED BY BURLEIGH ROCK DRILL CO. SEND FOR PAMPHLET. FITCHBURG MASS.

Steel Castings

From ¼ to 15,000 lb. weight, true to pattern, of unequaled strength, toughness, and durability. 15,000 Crank Shafts and 10,000 Gear Wheels of this steel now running prove its superiority over all other Steel Castings. Send for circular and price list. CHESTER STEEL CASTINGS CO., 407 Library St., Phila., Pa.

SUPPLIES FROM HYDRANT PRESSURE the cheapest power known. Invaluable for blowing Church Organs, running Printing Presses, Sewing Machines in Households, Turning Lathes, Scroll Saws, Grindstones, Coffee Mills, Sausage Machines, Feed Cutters, Electric Lights, Elevators, etc. It needs little room, no firing up, fuel, ashes, repairs, engineer, explosion or delay, no extra insurance, no coal bills. Is noiseless, neat, compact, steady; will work at any pressure of water above 15 lb.; at 40 lb. pressure has 4-horse power, and capacity up to 6 or 8 horse power. Prices from $15 to $250. Send for circular to THE BACKUS WATER MOTOR CO., Newark, N. J.

Shafts, Pulleys, Hangers, Etc.

Full assortment in store for immediate delivery. WM. SELLERS & CO., 79 Liberty Street, New York.

IT PAYS to sell our Rubber Hand Printing Stamps. Circulars free. G. A. HARPER & BRO., Cleveland, O.

FOR SALE.—One of Waters' Patent Feed Water Heaters. Was in use about two years. Believed to be as good as new. Cost $[illegible]. Will be sold for $[illegible]. SCHOOL & BLAKELY, Evening Star Office, Phila., Pa.

BROWN'S PAT. SPLIT PULLEYS Shafts, Hangers.

At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

A NEW TREATMENT

COMPOUND OXYGEN. NOT A DRUG.

for Consumption, Asthma, Bronchitis, Catarrh, Dyspepsia, Headache, Debility, Neuralgia, Rheumatism, and all Chronic and Nervous Disorders.

ACTS DIRECTLY upon the great nervous and organic centres, and cures by a natural process of revitalization.

HAS EFFECTED REMARKABLE CURES, which are attracting wide attention.

HAS BEEN USED BY Rt. Rev. John J. Keane, Bishop of Richmond, Va., Hon. Wm. D. Kelley, T. S. Arthur, and others, who have been largely benefited, and to whom we refer by permission.

IS STRONGLY ENDORSED: "We have the most unequivocal testimony to its curative power from many persons of high character and intelligence."—*Lutheran Observer.* "The cures which have been obtained by this new treatment seem more like miracles than cases of natural healing."—*Arthur's Home Magazine.* "There is no doubt as to the genuineness and positive results of this treatment."—*Boston Journal of Commerce.*

THE OXYGEN HOME TREATMENT contains two months' supply, with inhaling apparatus and full directions for use.

SENT FREE: A Treatise on Compound Oxygen, giving the history of this new discovery and a large record of most remarkable cures. Write for it. Address Drs. STARKEY & PALEN, 1109 and 1111 Girard St., Philadelphia, Pa.

ADMINISTERED BY INHALATION.

FIRST GRAND Millers' Exhibition,

TO BE HELD IN
EXPOSITION BUILDINGS, IN CINCINNATI,
FROM
May 31st to June 26th inclusive.

Six Automatic Cut-off Engines to be Tested.

Ten Complete Flour Mills in Operation.

A Complete Vienna Bakery.

Mill Machinery from all Quarters of the Globe.

Reduced Railroad Rates.

Ample Hotel Accommodations.

"BUCKEYE" LAWN MOWER.

The lightest and easiest running Mower ever made. STRICTLY FIRST CLASS. MAST, FOOS & CO., Springfield, Ohio. Send for catalogue.

A PLANING MILL OUTFIT FOR SALE very low for cash. Will sell all together or each machine separate. All first-class machines, good order. J. H. KERRICK & CO., Indianapolis, Ind.

FRIEDMANN'S PATENT INJECTOR. The best

BOILER FEEDER

In the world.

Simple, Reliable, and Effective.

40,000 IN ACTUAL USE.

NATHAN & DREYFUS, Sole Manufacturers, NEW YORK.

Send for Descriptive Catalogue.

SECOND-HAND BLAKE CRUSHER for sale cheap. New pattern, [illegible]. Address P. O. Box [illegible], Baltimore, Md.

THE [illegible] PUMP [illegible] LINE [illegible] MACHINE SIMPLE EFFICIENT [illegible] JAMES BOYER [illegible] FRONT ST. PHILA.

The Asbestos Packing Co.,

Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:

PATENTED ASBESTOS ROPE PACKING,
" " LOOSE "
" " JOURNAL "
" " WICK "
" " MILL BOARD,
" " SHEATHING PAPER,
" " FLOORING FELT,
" " CLOTH.

Leffel Water Wheels,

With recent improvements. Prices Greatly Reduced. 8000 in successful operation. FINE NEW PAMPHLET FOR 1879, Sent free to those interested. James Leffel & Co., Springfield, O. 110 Liberty St., N. Y. City.

PORTLAND CEMENT,

From the best London Manufacturers. K. B. & S. AND BURHAM CEMENTS. For sale by JAMES BRAND, 85 Beekman St., New York.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc. HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

CARY & MOEN STEEL WIRE OF EVERY DESCRIPTION AND STEEL SPRINGS. 234 W 29 ST NEW YORK CITY

Holly's Improved Water Works.

Direct Pumping Plan. Advantages: 1. Secures by variable pressure a more reliable water supply for all purposes. 2. Less cost for construction. 3. Less cost for maintenance. 4. Less cost for daily supply for all use of Holly's Improved Pumping Machinery. 5. Affords the best fire protection in the world. 6. Largely reduces insurance risks and premiums. 7. Dispenses with fire engines, in whole or in part. 8. Reduces fire department expenses. For information, address the HOLLY MANUFACTURING CO., Lockport, N. Y., Or PARK BENJAMIN & BRO., Gen. Agents, 49 and 50 Astor House, N. Y. City.

PROSPECTUS OF THE Scientific American FOR 1880.

The Most Popular Scientific Paper in the World.

VOLUME XLII. NEW SERIES.

Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

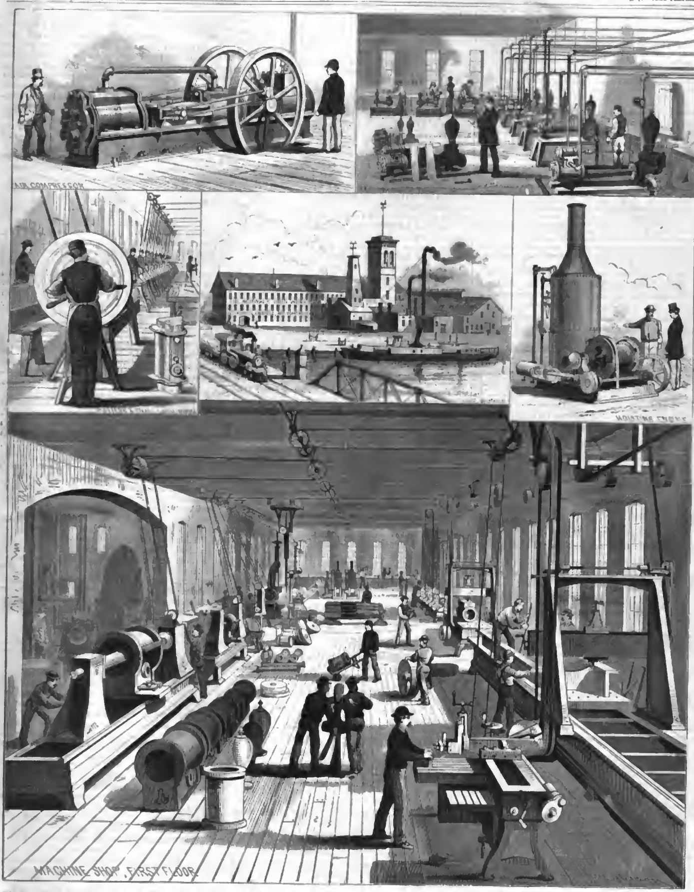
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 24. [NEW SERIES.] NEW YORK, JUNE 12, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]



THE NORWALK IRON WORKS COMPANY, MANUFACTURERS OF AIR COMPRESSORS, STEAM PUMPS, AND ENGINES.—[See page 376.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, JUNE 12, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 232.

For the Week ending June 12, 1880.

Price 10 cents. For sale by all newsdealers.

THE FUTURE OF THE ELECTRIC RAILWAY.

It is now nearly forty years since Professor Page's discoveries in electricity suggested to him the possibility of an electric railway; but in those days the costly galvanic battery was the only source of electricity available for such purposes, and his experimental electric locomotive was a practical failure. His power cost too much, and his machine labored under the disadvantage of having to carry a considerable load of battery cells, the action of which was materially interfered with by the jarring and oscillation of the train when its speed approached three or four miles an hour.

The development of dynamo-electric machines during recent years has so lessened the cost of electricity as a motive power as to remove the most serious obstacle to the success of Professor Page's experiments. During the same time the transmission of powerful currents of cheaply generated electricity, through conductors of considerable length, and the re-conversion of such currents into working force by economical motors, have become a matter of every day occurrence. It is quite natural and appropriate therefore that the problem of electrical propulsion should again come to the front, this time with every prospect of a speedy solution.

The problem had so long been in abeyance that when Dr. Siemens set up his electrical merry-go-round in Berlin last year, most men were disposed to look upon him as the propounder of a radically novel idea, and the electric railway as the product of the latest speculative thought in this direction. And when Mr. Edison adopted the system for practical use not a few people thought that he had switched off from the line of practical work to play with a novel toy, the outcome purely of his experiments in electric lighting.

The electric railway, however, is not a plaything. It is a practical reality, though just now entering upon the stage of useful and economical development. It opens a field of invention and improvement as wide and profitable probably as was opened up by the first steam locomotive; and we have no doubt that during the next fifty years it may work as great changes in the processes and economies of life as steam railways have during the half century just past.

On the little electric railway set up by Dr. Siemens in Berlin, the locomotive obtained its power from a special electric conductor running between the car rails, the current being returned through the rails. Mr. Edison has simplified matters by throwing out the central cable as a needless expense. He makes the track itself the conductor, sending the current up one rail and down the other, the locomotive being operated by the current forming a circuit through it when proper connections are made, as described in the SCIENTIFIC AMERICAN last week.

For readers unfamiliar with electrical motors it may be necessary to say that the power for the running of the electric locomotive is generated by a stationary boiler and engine, and transformed into electricity by an electric generator at the central station. As was suggested by the elderly lady fearful of boiler explosions, the water is boiled at home, and that source of danger is removed from the list of traveler's risks. And as the efficiency of a stationary engine is several times greater than that of a locomotive engine, it is possible to convert the power of a stationary engine into electricity, transmit it to the locomotive upon the track, and there reconvert it into working force as economically as (if not much more economically than) power can be directly evolved by the combustion of coal in a locomotive furnace.

In the present stage of his experimental apparatus, Mr. Edison claims that he can realize in his locomotives seventy per cent. of the power applied to the electrical generator. The track is spiked to ties, as in the construction of an ordinary railway, and the loss of electricity in transmission is not more than five per cent., even when the track is wet. If there is no error in these figures, and we see no reason to suspect them, the economy of the electric railway is established. Its apparent advantages over steam roads are numerous. In the first place, the locomotive is light, comparatively inexpensive, and does not require a fireman or a skilled engineer to run it. The lightness of the locomotive greatly relieves the track, which need not be nearly so strong and heavy for a given service. The wheels of the locomotive can be given any desired traction upon the rails, so that a light engine can pull a train up grades which are entirely impracticable with the ordinary locomotive. The track may therefore follow any ordinary road; and when the road is used purely for freighting, as in conveying ores from mines, the road may run where other roads would be quite impracticable.

For city use, the electric railway promises to be exceptionally useful, both for the conveyance of passengers and for carrying packages. Cars propelled and governed by electricity might supersede horse cars on the surface roads; and, even if no cheaper, the sanitary advantages of the electric road, resulting from the disuse of horses, would be considerable. Indeed, it is not impossible that the city of the future may dispense with horses entirely for general trucking as well as for passenger traffic, the roadways being laid with numerous lines of flat rails transmitting the power required for propelling carriages of every sort. The absence of noise, dust, friction, and the inevitable filth attending the use of horses, promises in the new dynamo-electric period a wonderful mitigation of the present evils of city life. On the elevated roads the lighter electric engines would be comparatively noiseless, and, unlike steam locomotives, would not be constantly pouring into the air sparks, cinders, and other offensive products of combustion; and the same power which propelled the cars would light them.

But, without attempting to forecast the distant future, it is easy to foresee abundant immediate applications of the new, silent, wholesome, and economical method of transmitting and applying energy. The mining regions of the West, as well as our Eastern coal mines, present unlimited opportunities for its employment in hauling ores out of the mines along the mountain ravines and over their precipitous sides. The experiment of plowing by electricity transmitted from a central generator was tried last year with encouraging success. The same plant would answer for the operation of cultivators and harvesters; and with a light, movable railway track, the same power would suffice to do the heavy hauling incident to farm work; and one of the great advantages of electric carriage would be shown here, as elsewhere, in the facility with which it can be operated from a distance. The wagon, loaded or empty, would need no driver, and could be trusted alone to pursue an even course between stations. By means of suspended cable-tracks the roughest regions could thus be safely and economically traversed either by small passenger cars, mail bags, or freight carriers; and the constant flow of evenly distributed small loads along such a line would aggregate as large a tonnage as is now transported over solid and costly roads in long but widely separated trains.

We have already experienced in the telegraph and the telephone the advantages of electricity as a carrier of thoughts and sounds. Who can tell but, when its capacities as a carrier of men and things have been fully developed, the electric telegraph and the telephone will be eclipsed in scope and utility by the electric road? Its possibilities are infinite; and it is the disposition of the men of these days to crowd the possible in every direction.

DEEP MINES IN NEVADA.

The depth attained is as follows: The Utah 1,980 feet, the Sierra Nevada 2,500, the Union Consolidated, Mexican, and Ophir, each 2,500, Consolidated Virginia and California 3,300 each. Best and Belcher 2,000, Gould and Curry 2,200, Hale and Norcross and Savage 2,400, Chollar 2,400, Ward vertical shaft, 2,168, Combination shaft 2,440, Yellow Jacket 3,000, Belcher 3,000, Crown Point 2,800, Overman and Caledonia each 1,900, Alta and Benton each 1,950, Silver Hill 1,300, Consolidated Imperial 2,800, Bullion 2,300 feet.

FOOD ADULTERATION.

The Chicago *Inter-Ocean* introduces an official report of an examination of the vinegar sold in that city, with the startling head lines: "*Adulterated Vinegar. Results of Analyses of Twenty-four Samples by the Health Department Chemist. Discovery of Foreign and Unwholesome Ingredients Wholly Unfit for Food.*"

Nothing short of wholesale and dangerous adulterations could be looked for under such a heading; an expectation, we are happy to say, not at all justified by the report which it covered. After a number of preliminary statements with regard to the specific gravity, color, odor, etc., of vinegar, the chemist says:

"Vinegar should contain at least three per cent. of acetic acid. Three samples, Nos. 9, 10, and 22, do not come up to this standard, and should therefore be looked upon as adulterated.

"Here, again, I find sample No. 22 has been adulterated by the addition of hydrochloric (muriatic) acid, and its use should not be permitted. The vegetable acids, as I have termed them, are not necessarily hurtful.

"The examination for the poisonous metals, lead and copper, was made in the acid solution of the ash of the vinegar. It has been exceedingly carefully conducted, as it is well known that the habitual use of any food or drink, containing even very minute quantities of these metals, has a very deleterious effect upon the human system. Sample No. 17 is the only one containing a dangerous metal, namely, copper, and its sale should at once be prevented.

"Looking at these samples of vinegar as a whole, they are very good, and will compare very favorably with the general run of vinegars. No objection can be taken to any but those that I have already individually mentioned, namely, Nos. 9, 10, 22, and 17."

That there should be four objectionable samples of vinegar out of twenty-four, is certainly to be deplored; still more that one of the four should contain a trace of copper, due probably to the use of improper utensils in making or handling the vinegar. But is it not even more deplorable that a reputable newspaper will cater to popular ignorance and prejudice, and intensify them, by such misleading displays of lying type?

We are much inclined to believe that, in the majority of cases, the general adulteration of food stuffs by grocers and manufacturers, as charged by certain uncritical writers, will be found to rest upon as small a basis of fact as the *Inter-Ocean's* alleged "war upon vinegar venders" by the Chicago Board of Health.

THE AMERICAN CHEMICAL SOCIETY.

The May Conversazione of the society was held at the University building, Washington Square, on Thursday evening, May 20. Among a number of very interesting exhibits, the following are worthy of notice:

Dr. Arno Behr exhibited a solution of copper sulphate,

containing an abundant growth of filamentous fungi. This solution contained about three and a half per cent of ordinary pure copper sulphate; and the fact that copper salts are usually considered inimical to living organisms makes this exhibit interesting.

The same gentleman also exhibited a remarkable leather-like deposit found in a dust flue of a sugar refinery. It was made up of layers of filamentous tissue, and was probably formed by the growth of fungi, which exude a kind of glue-like material that cements the various layers together. This material was quite tough, like thin leather, and of a nut-brown color. It often occurs covering a surface several feet in area, and has the appearance of a coat of paint.

Some black scale from the interior of the retorts used in making bone-black was also exhibited by Dr. Behr. This material appears to eat into, and, finally, through the retorts, making it necessary to replace them occasionally. It consists of some carbon, together with sulphide of iron, and appears to act by giving up its sulphur to the metallic iron of the retort, becoming reduced to a lower sulphide, which in turn acquires new sulphur from the sulphates in the bones burnt, and also from the albumen which they contain.

A filter press of Wyelin & Hubner, to be used in laboratory experiments, was also exhibited by Dr. Behr. It consisted of a filter-press with Montejus' attachment; which latter is simply a large vessel to hold the liquid to be filtered. The liquid is forced from the bottom of this vessel by means of compressed air, from the pump attached, acting on its surface.

In answer to a question as to the kind of industries in which these presses were used, it was stated that they could be adapted to every conceivable want, and that they were now being used in the United States to filter beer.

Dr. Behr said that the advantage of this press with the Montejus' attachment was that the flow of liquid through the press was steady; while by using the simple pump press without Montejus' attachment the intermittent action of the pump often caused a turbidity in the filtrate.

A specimen of the new metal gallium made by the discoverer Lecoq de Boisbaudran was exhibited by Dr. C. T. Chandler. It was only a few millimeters square, but was interesting as the first specimen seen in this country. It is a hard white metal, melting at the heat of the hand.

Dr. Chandler also exhibited a specimen of naphthaline taken from the main leading from the retorts to the gasometer of the Municipal Gaslight Company. This company makes gas by passing steam over red-hot anthracite coal, and the resulting mixture of carbonic oxide and hydrogen is carbureted by passing it through petroleum naphtha, and then through red-hot retorts again. The naphthaline deposit exhibited shows the conversion of the hydrocarbons of the paraffin series into those of the aromatic series by heat.

Prof. A. R. Leeds, of the Stevens Institute, exhibited a beautiful piece of glass work by Prof. Richards, of the Massachusetts Institute of Technology. It consisted of a very ingenious regulator, to maintain a constant temperature in a hot-air oven for laboratories. It was made entirely of glass, and much admired for its fine finish. Dr. Leeds said that this apparatus worked very satisfactorily.

ARTHUR H. ELLIOTT,
Recording Secretary.

OYSTERS AT QUINNIPIAC.

The original purchasers of the territory of New Haven County, Conn., found a tribe of Indians on the ground called Quinnipiacs. In selling to the English they still retained their rights to fishing and hunting. The river Quinnipiac, which is the eastern boundary of the city of New Haven, had long since been a famous place for oysters. These bivalves were also abundant along the shores east and west of New Haven. The Indians had depended much upon them for food. The new settlers did the same also. The banks along the shore are lined, several feet deep, with shells left by many generations of oyster eaters.

The shore at Fair Haven, which is the eastern part of New Haven, was once a favorite resort for seals. To the excited imagination of the first white settlers these aquatic beasts seemed like "dragons," hence they named the locality "Dragon," a title it long held. The present name is explained in a letter written by Rev. John Davenport, first minister at New Haven, to Lady Mary Vere, in England, in 1639. "After ye ship came in, guided by God's own hand, ye sight of ye harbor did so please ye captain of ye ship and all ye passengers, that he called it the Fayre Haven."

For nearly two hundred years the dependence of the people seeking this shore of Long Island Sound with its bays and estuaries for oysters, was upon the natural supplies. These seemed inexhaustible, as the habits of use then were. The Indians who came from the interior at certain seasons and remained for weeks, living mainly upon shell and other fish, carried none away with them. The whites only visited the shores for an occasional "salting." No restraints were imposed by the towns until about one hundred years ago. Then, and for many years, the restraint was only upon certain very accessible localities and for certain months.

As most of the oysters gathered were taken from ground left bare at low water, or in very shallow water, no special ingenuity or skill was called out in obtaining them. It being found that these shallow water beds were unreliable, deeper water was sought after a while. Cold weather often killed the oysters left bare by winter tides. Storms covered them with sand. Moreover, increasing numbers of people seeking oysters soon cleaned the beds that were so easy of access. Then invention and mechanical skill were active in contriving rakes, boats, etc., to enable the oystermen to secure a supply. It would greatly interest the archæologist to visit one of these shores and note the specimens of contrivance and art to facilitate the taking of bivalves.

One of the results of an increasing love of oysters was the growth of a class who sought a livelihood by selling as well as catching these shell-fish. Hence a business began to be developed. But there were no private grounds. The various natural beds were open to all persons in the State who wished to take oysters therefrom. The only restriction put upon the people was the reserving of several months as "close" months each year, during which no oysters could be caught. These were the summer months, when the bivalves were known to be giving off their spawn.

The "law was off," as the expression was, about November 1st. In anticipation of that time great preparations were made in the towns along the shore, and even for twenty miles back from the seaside. Boats and rakes, and baskets and bags were put in order. The day before large numbers of wagons came toward the shore from the back country, bringing hundreds of men with their utensils. Among these were not unfrequently seen boats borne on the rigging of a hay cart, ready to be launched on the expected morning. It was a time of great excitement. So eager were men to be first on the ground that many could not wait till morning dawned. As soon as the clock tolled the midnight hour a great number of men rushed to the shore and into the boats and began operations. In a few hours the crowd was such, on some beds, that the boats were pressed close together. They were all compelled to move along as one, for none could resist the pressure of the multitude. The more thickly covered beds were quickly cleaned of their bivalves. The boats were full, the wagons were full, and many had secured what they called their "winter's stock" before the day was done. Those living on the shore usually secured the cream of the year's crop. They knew just where to go, they were better practiced in handling boats, rakes, etc.; they formed combinations to help one another.

That first day was the great day. It presented an exciting scene. Often crowds of spectators came to look on, as at a fair or Fourth of July parade. Sometimes in the pushing, crowding, and eagerness of getting there, would result wrangles, and even fights; but generally the men kept good-natured and made the best of all the discomforts and hardships of the day's crabble. The oysters were very poor then compared with what are now obtained. Such indiscriminating raking caught them before they were half grown Nor were there many to be caught after that first day. In a week or two later a bushel of oysters could not be bought for less than four dollars.

It was apparent to thoughtful minds that a new policy must be pursued if the people were to continue to have oysters. There were fitful gleams of hope as new beds were occasionally discovered. But the same process of speedy exhaustion followed. Some tried to preserve what they had obtained until they grew larger by laying them down again. But all oysters found in the water were treated as common property. Whoever found them felt free to help himself. Two young men having gathered a few hundred bushels, spread them on the flats near where they lived at West Haven. They tended them carefully, hoping to realize quite a sum as a reward. Just as they were bargaining to sell them a plot was carried out thus: Several parties came from ten miles in the country, by night, with rakes, baskets, and wagons, and carried the oysters all away. When the owners sought their property in the morning it was far on the road to the cellars of certain persons in Woodbridge and North Orange.

For thirty years past efforts have been persistently made to enable men to own ground under water, that they might preserve and grow oysters. Considerable progress has been made through both legislative and town acts. But it has been a slow and difficult process. People have been very reluctant to grant to individuals what they felt should be reserved for all. The towns of New Haven County and the State of Connecticut are at present most forward in measures for encouraging oyster farms under their waters.

The Quinnipiac River, New Haven Harbor, and the waters adjacent have for some years been all assigned to private parties.

The first use made of such grounds was to lay down oysters brought from other waters, especially Southern bays. A very large trade grew up in Virginia and Maryland oysters, brought to Fair Haven to be opened and sold over the New England and other Northern States. For some late years as many as one million bushels have been brought annually to this place from the South. Such oysters are greatly improved by even a few weeks' feeding in the waters of our bays and river mouths.

Formerly these oysters were sent around to private houses to be opened. Different members of the family, men, women, and children engaged in this work. A large part of the rapidly growing population found remunerative employment in this way. In later years shops have been built along the shores, in which this work is done. Still later, many oysters are opened on the Southern shore before being brought North. These opened bivalves were first put up in small wooden kegs, holding from one to two gallons each. They were shipped to different parts by railroad or stage or private teams. Before the building of the New York and New Haven Railroad the dealers sent large teams, drawn by two and four horses, loaded with these little barrels of oysters, as far west and north as Albany, N. Y. Of course this could be done only in the colder months. While still using the same means of packing, other forms have been introduced. The most common receptacle now is a strongly made tub, with a lid which securely fastens. Each, containing a number of gallons, is furnished with handles, with which it can be easily lifted. In warm weather ice is put in with the oysters. Tin cans are used to a considerable extent. These are filled and soldered, then packed in wooden boxes with ice between. Thus, as with the tubs, oysters are carried long distances in good condition even in summer. Several ingenious contrivances have been patented that are in use to pack, fasten, carry, and preserve this widely popular article of food. An extensive tub, barrel, and pail making business is carried on in Fair Haven itself.

Perhaps the most important changes and improvements are now being made. Necessity has compelled the oyster man to learn many things. As in nearly everything besides, it is found that natural sources of supply are not adequate to the increasing demand. Hence the great attention is directed to the duty of artificial production. The oyster is wonderfully prolific. Each mother sends out millions of her young every season. How to secure this increase from destruction, that it may grow to be useful, is now the study. This involves the necessity of having suitable ground on which the young will "set," can be protected from enemies in the water and out of it, and still be within reach of the cultivator. The old methods have mostly "had their day." The conclusion reached is: that cultivation must be the great resource; it needs deep water for assured success, and it must have the aid of steam power. All these results are being successfully worked out in the Fair Haven oyster industry. There are serious natural obstacles, and some artificial. Among the latter I would name injudicious, because hasty, legislation. This hinders instead of fostering enterprise. But as our citizens become more satisfied of the value of this means of food supply that obstacle will disappear.

Among the natural I would name, first, *the expense*. A deep water planter must have a large amount of land; he must employ steam power; he must have a number of helpers; he must have a large market; he will be especially exposed to the ravages of "five fingers," "drills," and other vermin which are liable to assail oyster beds; he must try some expensive experiments; he will be in danger of spending much upon ground that after all may prove unsuitable.

Formerly, when there were natural sources of supply, any man with a boat and rake could start a business. Many men beginning thus have attained a comfortable competence. Now, there is not this opportunity. One must first secure a piece of ground. He must then cover it with shells, and wait for a "set." It will then be three or four years before his oysters will have grown large enough for market. Shells that once could be had for the carting must now be bought.

Oyster spawn when thrown off by the mother soon seeks some clean shell or gravel on which to fasten or "set." This is why new ground needs to be covered with clean shells or stones. Oyster spawn will not "set" on mud or muddy, dirty, or greasy matter, even if on shells. Hence shells are much in demand for preparing new ground. Shell lime has become more costly, because shells have risen in price. Once they cost the lime makers nothing.

All shell-fish are improved by an infusion of fresh water. This explains the superiority of the shell-fish of the northern coast of Long Island Sound to those on the southern coast of the same water. Many fresh water streams flow in from the north; none flow in from the south.

Oysters brought from the South, or from the deep waters of the Sound are usually quite salt, and should spend a few days in fresher water to be in good condition. Cultivators now have "floats," which are rafts of timber, in which they place their oyster near or within the mouth of some river for a short time before using. One reason of the fine flavor of Fair Haven oysters is the flow of fresh water from the Quinnipiac, Mill, and West rivers.

Changing oysters from their place of "setting," in a year or two, benefits them. They have more room and take a better shape.

Cultivation has greatly increased the supply of good oysters. In New Haven, ten years ago, it was difficult to secure ten bushels at short notice. Now five hundred bushels can be obtained in a few hours.

Two causes are giving cultivation here a new inspiration; the recent laws in Virginia and Maryland, which are likely to greatly diminish the supplies from the South, and the great call for seed oysters to be taken to Europe.

Science is giving much assistance toward understanding the nature, habits, needs, and possibilities of the oyster as a means of food supply. It has also greatly facilitated the invention and construction of machinery for the prosecution of the oyster trade. Prof. Verrill, of the Peabody Institute, in New Haven, has done good service to the cultivators in this vicinity as well as elsewhere. All feel that the business is only in its infancy as yet.

The Human Retina.

In a recent note to the Vienna Academy, Herr Salzer offers an estimate (based on numeration) of the probable number of optic nerve fibers and of retinal cones in a human eye. The number of the former he supposes to be about 438,000, that of the latter 3,360,000. This gives seven or eight cones for each nerve fiber, supposing all fibers of the optic nerves to be connected with cones, and equally distributed among them.

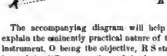
BINOCULAR VISION IN TELESCOPES.

BY CHARLES D. BOYLE.

Carefully executed drawings of the double-eyed comet seeker and large binocular equatorial were submitted, a few years ago, to the late Prof Henry, of the Smithsonian Institution, with a view to having their practical value considered by our government authorities. Prof. Henry returned them accompanied by a written report, transmitted to him by the astronomer then in charge of the Naval Observatory, in which the latter asserted that "the construction of a comet seeker on the proposed plan would be impossible," while this very comet seeker had been in existence as a complete success for seven years preceding the date of the report, in which it was also asserted that "the great binocular equatorial would be doubly expensive and with no advantages over the usual form." In the letter accompanying the report, however, Prof. Henry expressed his non-concurrence in the views it announced, which we shall now see were advanced by one who, though in position to slam the door in the face of national progress in this respect, must have been wholly unfamiliar with the optical nature of such instruments.

The instrument known in astronomy as a *comet seeker* is much shorter in proportion to its aperture, or diameter of object glass, than those used for ordinary purposes; the one herewith presented having an aperture of six inches and a focal length of four feet two inches, while a telescope of like diameter, built for ordinary observation, will seldom have a focal length of less than seven feet six inches. The object of making the comet seeker so relatively short in focus is because the images formed in its field of vision are brighter in proportion as its focal length is short in comparison with the width of its objective or object glass. In such telescopes an object would be visible whose light would be too feeble to be seen in the field of an ordinary instrument. As a rule, therefore, it is with the comet seeker that all primary researches of the heavens are made, the persevering observer sitting night after night patiently sweeping the heavens in the hope that some feeble speck before unknown to astronomers may present itself in the field of his telescope. It therefore occurred to the writer that, as the comet seeker used up to the present time had but a single eyepiece, and therefore a single field of vision, it might be improved by an additional eyepiece and another field of vision which would bring both eyes of the observer into requisition, and as both eyepieces would be "columated" with rays coming through the center of the object glass, they would each bring into view different sections of the heavens, thus enabling the observer to keep constantly under observation double the quantity of sky that the ordinary comet seeker presented to him. This telescope is so constructed that one of the eyepieces is columated in coincidence with the optic axis of the objective, the other being situated to one side the width that a man's eyes are apart, and directed through the center of the object glass.

The only difference between the image of a star seen in the field of this eyepiece and that which is centrally columated, being that in the first the image is round, whether in or out of focus, and in the latter the star, when out of focus, throws out "a wing" to one side, but when brought into focus the image is just as bright and as perfect in shape as the other.

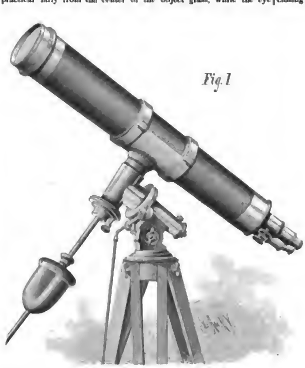


The accompanying diagram will help to explain the eminently practical nature of the instrument, O being the objective, R S stars located in different portions of the heavens, the images of which appear in the fields marked with corresponding letters. The advantage of this instrument over the ordinary comet seeker is that it enables the observer to see twice as much of the heavens, and therefore doubles his chances of finding objects; that in one hour he can search over as much area as he formerly could in two, and consequently it enables one observer to do the work of two.

The illustration, Fig 1, represents the double-eyed comet seeker as it was constructed. Both eye pieces may be used together by a single observer, or by their proper adjustment two observers may use the instrument at the same time.

The eye-glass, A A, in illustration, Fig. 2, is "columated" with the object glass, O, that is to say, its axis is coincident with a line proceeding perpendicularly from the center of the object glass, while the eye glass, represented by B B, Fig. 2, has its axis coincident with a line oblique to the object glass, but passing through its center; the lines of vision from the different eyes therefore converge to a point in the center of the objective, crossing each other there, and thence proceeding into space at the same angle. The two different sections of the heavens thus brought under observation form apparently a single field of view in the telescope, being visually superimposed upon each other the same as the two pictures in a stereoscope, from which it will be obvious that when an object presents itself we can ascertain which field of view it is in only by closing one eye. If a single star, after becoming visible in the field, disappears when we close the *right eye*, then we know that we have been seeing it with *the right eye*, but if it remain visible then it must be in the left-hand field, for we continue to see it, and necessarily with the unclosed eye; therefore, when a strange object presents itself in the field its position in the heavens can at once be established by the simple process of closing one eye.

Fig. 1



BINOCULAR COMET SEEKER.

The authority who, in a written report, declared that a comet seeker, which had been a complete success for years, was impossible of construction, is not wholly reliable, though occupying a high place in the nation's trust. Let us now consider what may possibly be the merits of the great binocular telescope upon which also he pronounced sentence of extinction. The simplicity of its construction is so obvious, and the union of its binocular vision so remote from complication, that it is hardly necessary to discuss its optical qualities, as there can occur in such a structure only the positive results indicated by its combinations.

The nature of binocular vision is very little understood, because very little considered. It is now some years since I urged its claims upon a telescope manufacturer who has not his superior in the world so far as the practical manipulations of an achromatic object glass goes. He, however, repudiated the value of such combinations, declaring them worthless above the size of an opera glass, asserting at the same time that when the tubes were greater than that length they could not be adjusted so as to see a single star, and that when directed to a single star such an instrument would be sure to see two images instead of one; that, added to this defect, it would only increase the illumination by one thirteenth. Thus repelled at every point I was forced to take up the practical construction of such telescopes, and found them not only easy of adjustment, but really more than twice as luminous, for the simple reason that seeing with one eye is mutilation, and a man can no more see half as well with one eye as he can with two, than he can walk half as well with one leg as he can with two, consequently our entire system of telescopic observation up to the present time is mutilation, and a time is coming in the future when the heavens will render up to binocular vision vast resources of knowledge which will be withheld from man as long as he persists in squinting at them with one eye under the lofty impression that he knows more about the relative value of eyes than the Cause that created him.

Certainly two eyes are absolutely necessary to the proper appreciation of the form, distance and illumination of terrestrial objects, and there appears no reason why two eyes may not be as profitably employed on celestial objects.

We can readily measure the magnifying power of a single telescope as compared to the unaided eye by keeping both eyes open when viewing an object through the instrument and directly comparing the relative sizes of the images seen by each eye, but in the case of a binocular telescope this is impossible, because we have not a third eye to spare to view the object unaided, nor indeed if we had would there appear to be the slightest difference between the magnifying power of two telescopes as compared to that of one alone. The difference of illumination and amplification can only be made perceptible by referring the comparison to impressions produced upon the organism which receives them. We can make this obvious by adjusting upon some object a binocular telescope, view the object for a moment with a single eye until we have its apparent size and illumination determined as near to a positive quantity as we can, then suddenly open the eye at the other telescope, and as suddenly the image will seem to start into increased amplification quite as great as double the magnifying power would have produced upon the single eye. But the brilliancy of the image will be eight times greater, as any mathematician can demonstrate, because increasing the magnifying power to double the diameter would decrease the intensity of illumination to one quarter of its original brilliancy; whereas the brilliancy of image, in the case of the binocular, is increased to twice the original quan-

Fig. 3

BINOCULAR TELESCOPE, WITH MICROSCOPIC OBJECTIVES.

tity, and therefore to double its original intensity. It needs no far fetched philosophy to prove to ourselves that the brilliancy of the binocular telescope is doubly as great as that of a single telescope of like aperture and focal length, for we know that twice as much light enters two eyes as enters one, and is united by the brain in a single field. If a doubt could exist upon this point we have only to make a tube by rolling up a sheet of paper, place its end about one eye, so as to shut out all light but that which enters the tube, and direct our vision toward a plane surface in low light, for in low light we will be better able to appreciate the difference of illumination. The surface brought under examination will everywhere appear as an even tint except the portion bounded by the tube, which will come out as a bright spot upon a gray background. Independent of every other proof this fact alone demonstrates that two eyes double the illumination of all images of external objects formed on the retina; again therefore it is proved that the binocular telescope is doubly as luminous as the single one of like aperture and focal length, and as it is well known that space penetrating power is invariably proportioned to the brilliancy of illumination produced in the field of view, it follows from this *one* superior quality alone that a binocular telescope has double the value of a single one for all purposes of astronomical research. But since an amplification of the image accompanies this increase in brilliancy, we must also have the equivalent of an increase, in the magnifying power, of double that of the single instrument, and that, too, without increasing the power of the eyepiece, and consequently without any diminution of the field of view as would result from the use of an eyepiece of higher power. As it is a well known fact that all discoveries of celestial objects, and all our most accurate micrometric measurements, have been made with low powers, it follows that the binocular instrument combines all the valuable properties of the single instrument in more than double its proportions.

The great refractor in the National Observatory at Washington has a clear aperture of twenty-six inches and a focal length of thirty-two feet; another arranged for binocular vision and placed alongside of it would double the luminosity of the field of vision, and therefore have twice its space penetrating power. A single telescope, to have the same brilliancy of illumination or light transmitting power, would require an objective of thirty-six inches aperture and to be of the same focal length. But as it would be impossible to correct such a lens to the same degree of excellency as that of one of like focal length and less diameter, a like degree of perfection of figure could not be obtained; added to this, the lens would require to be at least one third thicker, and would therefore absorb light in a like proportion. As difficulties of this kind increase in proportion to the square of the diameter of the objective, it follows that a single refracting telescope cannot be made equal in space-penetrating power to a binocular refractor having measurements in duplicate to that now in the National Observatory, and *that* as it now stands has less than half the space-penetrating power which can be given it. This could be done by simply adding a duplicate instrument, making it binocular. This, however, is not all. A refracting telescope having a light-receiving capacity equal to such a binocular would require an objective of thirty-six inches in clear aperture, but owing to the increasing difficulties of correcting such a lens it would be necessary to increase rather than diminish its focal length; but if we assume it to be in exact proportion it will then require to have a focal length of forty-five and a half feet, which at once compels the building of an observatory of correspondingly increased proportions, and expenses would be double that of the binocular instrument, while the latter would still remain vastly superior to the former. Hence, instead of being, as the preceding report of the authority from the Naval Observatory asserts, *doubly expensive*, it would not be half the expense of a single instrument theoretically its equal, though practically far inferior. The nation, therefore, stands to-day with an observatory capable of accommodating a telescope of twice the space-penetrating power possessed by the one now mounted there, by the mere expense of the additional telescope. But the way to such obvious and cheap improvement is barred by an authority capable of committing himself in writing to the positive declaration that a telescope already constructed is impossible of construction, closing the door in the face of obvious progress, through *a knowledge* of, or a *want of knowledge* of the subject, we leave the reader to judge.

The great binocular telescope which I propose is capable, without additional expense, of adjustments with which one eye receives the light direct from the telescope and the other by prismatic reflection.

Whatever may be the nature of the power which created animal life, be it sentient or the unfolding of successive causes, it would not have been so particular to endow each race and each individual of each race with two eyes if there did not lie behind it some potent reason, for nature never wastes her resources any more than she forgives self-mutilation or any another transgression of her laws.

It is but a few years ago that a gentleman left with a professional astronomer for examination one of my binoculars of thirty inches focal length; after some time the astronomer reported that in using the instrument he found he could see just as well with one tube as with both, and with one eye as with two. In looking farther into the matter it turned out that the astronomer had nearly lost the use of one of his eyes from the fact that he invariably used the other

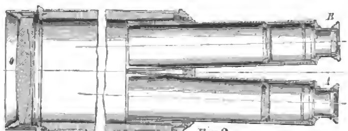


Fig. 2.

SECTION OF BINOCULAR COMET SEEKER.

when observing the heavens through his great telescope, by which its companion had become dimmed and mutilated, finally unfitting him for the normal binocular vision of every day life.

This same character of visual mutilation results from the

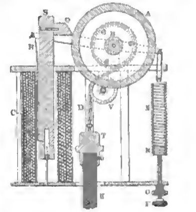


Fig. 3.—SECTION OF REGULATOR.

use of the one-eyed microscope, and has led to an effort to construct that instrument upon the principles of binocular vision. But as another law of vision has been transgressed in the instrument produced, the effect upon the eyes is yet

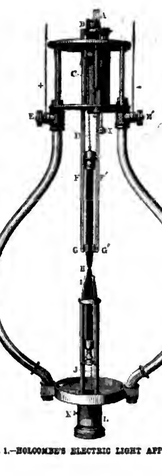


Fig. 1.—HOLCOMBE'S ELECTRIC LIGHT APPARATUS.

very unsatisfactory. In every case, however, where monocular vision is persevered in, nature will be sure to enter her protest by inflicting the common penalty.

The far off problems of space, and many of the nearer ones, will remain unsolved until a generation arrives upon the planet sufficiently in earnest to use the resources nature has endowed them with, and who will comprehend that self-mutilation is not one of the stepping stones to wisdom.

We now introduce the binocular microscopic telescope, so named because, by the mere placing of a lens of peculiar construction on each tube, it is changed from a telescope to a microscope having the power of magnifying objects at distances very much greater than were before attainable, thus enabling the observer to bring under observation objects situated at distances varying from one to ten feet.

As it is mounted on a tripod it can be stationed among the grasses and having universal motion, insect life can be followed and studied in the domain of their native activity, enabling the observer stationed in his easy chair to fill the office of war correspondent to the extensive, deadly, and desperative battles of ants which so frequently occur in summer time. Thus he can watch "the busy bee" as he trowels up the walls of his cells, and to superintend the operations and habits of insect life generally without disturbing the subjects or making them even aware that they are under observation. It has, however, graver phases to the medical profession, the power to bring under microscopic observation offensive diseases of the skin, while the observer is yards away from the point under examination. When the lenses are removed which make it a microscope, it is transformed into a telescope for ordinary terrestrial or astronomical use.

Fig. 3 presents A, the objective end of the binocular microscopic telescope, in its capacity of telescope, the lines of its vision being parallel, as shown by the continuation into space of the dotted lines, B B. C of the same illustration represents two cells containing portions of a lens whose original form and relative size is shown by their curves having a common connection; they are, therefore, oblique achromatic lenses cut from corresponding parts of a larger lens whose focus is at D. When the cells, C, are placed in position over the object glass of the telescope, as shown by the dotted lines there, its lines of vision will then be directed to the focus, D, of the lenses, C. Objects occupying this focus will appear magnified in proportion to the power used. The same result can be obtained by using ordinary magnifying lenses in connection with achromatic prisms.

This instrument is not intended to rival, or in any way to trench upon the domain of the table microscope, but to meet requirements for which the latter is not adapted. The table microscope can only examine objects located at very short distances from its objective, never greater than four inches, while the microscopic telescope will magnify them at the distance of ten feet and under. The table microscope is pre-eminently fitted for great magnifying power, and though the microscopic telescope may have its magnifying power increased *ad libitum*, the work it is designed for makes it undesirable to go beyond moderate magnifying powers. In examining a battle of ants, for example, it is necessary to keep the power sufficiently low to admit a group of the combatants into the field of view. Or, when an insect is found among the grasses, in his native jungles, tending to business, very high magnifying powers would make it impossible to follow his motions, as his apparent speed would be increased in the same proportions as his dimensions. If, however, the objects be stationary, there is no limit to the magnifying power which may be used so long as the illumination is sufficient. This principal is equally applicable to the single form of telescope.

The binocular microscopic telescope has been presented before the New York Microscopic Society, and the inventor had the honor to receive from that body its official vote of thanks for progress in microscopy, so that, as in the case of my double-eyed comet seeker, it is now too late to declare its construction to be an impossibility.

NEW ELECTRIC LAMP.

We illustrate herewith an electric lamp invented by Mr. Alfred G. Holcombe, of 31 Park Row, New York city. It possesses several points of novelty, and seems to be constructed on correct principles. The light is produced by means of an arc, and the regulation of the current is effected by an axial magnet having a core which contacts with a soft iron disk placed on an arbor carrying a drum on which is wound a chain connected with the upper or positive carbon carrier. The lower carbon is carried upward by a spring acting continuously, the rate of feeding depending on the rate of consumption.

In the engraving, A, is an iron disk mounted on an arbor at the top of the lamp. Upon the same arbor there is a drum, B, which supports the carbon by means of a chain, D. An axial magnet, C, at the top of the lamp contains a soft iron core, S, provided near its upper end with a beveled projection, Q, which lightly touches the iron disk, A.

The core, S, is connected with a wire, R, with a lever

that is pivoted on the arbor of the disk, A, and is connected with a spring, N, which opposes the action of the axial magnet, C.

The chain, D, runs over a sheave, V, to change its direction, and is attached to a carbon holder, T, placed between parallel vertical guides, F F'.

The guide, F', is pivoted and provided with a spring, which tends to throw its lower end toward the guide, F, and thus clamp the carbon, H, lightly between clips, G.

The lower or negative carbon is forced upward by a spring contained in the case, L, and its upward movement is checked by the platinum fingers, I, which reach over upon the base of the cone formed by the burning away, so that the lower carbon is fed upward only as it is consumed.

The arc is formed at H. The current to operate the lamp is taken through binding posts, E E, on opposite sides of the lamp. When the lamp is in operation and in its normal condition, the beveled nib, Q, of the core, S, of the axial magnet adheres to the iron disk, A, holding the carbons the proper distance apart to produce an arc suited to the current. Should the current increase, the core, S, is drawn downward into the axial magnet, thereby separating the carbons increasing the length of the arc. Should the current diminish, the spring, N, acting through the connecting lever, raises the core, S, and turns the disk, A, so as to bring the carbons nearer together. Should the current cease, the disk, A, is entirely released, and the upper carbon, H, descends of its own gravity until it touches the lower carbon, when it is in condition to receive the current and become relit.

The upper carbon may be raised at any time by pulling on the chain, X, which is wound upon the arbor of the disk, A, in a direction opposite that of the chain, D. The length of the arc may be varied by adjusting the spring, N, so as to offer more resistance to the action of the axial magnet.

The lower carbon and carbon holder may be readily removed from the lamp frame by turning the casing, L, a quarter of a revolution. And the spring actuating the carbon carrier may be stopped by pressing the button, K, when it is desired to put in a new carbon.

The lamp seems well calculated to avoid the imperfections found in other lamps. It gives a steady, strong light, with arc always in the same position. There is no lost mechanical motion, and the regulating mechanism absorbs an amount of energy equivalent to but one candle power of the current.

Why the Needle Points Northerly.

A San Francisco gentleman lately wrote to the Superintendent of the U. S. Coast Survey, Professor C. T. Patterson, asking the reason why the magnetic needle points to the north. In reply Professor Patterson wrote as follows, and possibly many more than the original inquirer may be glad to read his simple statement of the facts of the case.

The reason why the needle points in the northerly direction is that the earth in itself is a magnet, attracting the magnetic needle as the ordinary magnets do; and the earth is a magnet as the result of certain cosmical facts, much affected by the action of the sun. These laws have periodicities, all of which have not as yet been determined.

The inherent and ultimate reason of the existence of any fact in nature, as gravity, light, heat, etc., is not known further than that it is in harmony with all facts in nature; even an earthquake is in perfect harmony with, and the direct resultant of, the action of forces acting under general laws.

A condensed explanation in regard to the needle pointing to the northward and southward is as follows: The magnetic poles of the earth do not coincide with the geographical poles. The axis of rotation makes an angle of about 23° with a line joining the former.

The northern magnetic pole is at present near the Arctic circle on the meridian of Omaha. Hence the needle does not everywhere point to the astronomical north, and is constantly variable within certain limits. At San Francisco it points about 17° to the east of north, and at Calais, Maine, as much to the west.

At the northern magnetic pole a balanced needle points with its north end downwards in a plumb line; at San Francisco it dips about 63°, and at the southern magnetic pole the south end points directly down.

The action of the earth upon a magnetic needle at its surface is of about the same force as that of a hard steel magnet, 40 inches long, strongly magnetized, at a distance of one foot.

The foregoing is the accepted explanation of the fact that the needle points to the northward and southward. Of course no ultimate reason can be given for this natural fact any more than for any other observed fact in nature.

Cotton Planters' Association.

The annual meeting of the Mississippi Valley Cotton Planters' Association was held in New Orleans, May 18. The attendance was large. Resolutions were passed indorsing the Mississippi River Commission; claiming a right to representation in the National and State Cotton Exchanges; condemning the sale of cotton seed; approving the barge-line system of river transportation; and condemning speculations in cotton futures by cotton factors. The officers elected for the ensuing year are: President, F. C. Morehead; Vice-Presidents, J. W. Vicks, Mississippi; H. R. Lucas, Louisiana; J. B. Killebrew, Tennessee; S. B. Cockrill, Arkansas; and Dr. J. B. Taylor, Alabama.

NEW STYLE OF MOULDING.

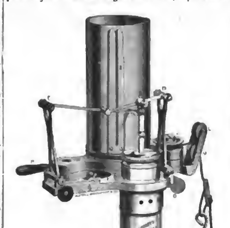
The annexed engraving represents a new style of carved moulding recently patented by Mr. H. D. Benjamin, of De Ruyter, N. Y. The moulding, although quite simple, is very ornamental, and may be applied to doors, windows, cabinets, bookcases, and many articles of furniture. It forms an elegant corner for secretaries, and may be modified to adapt it to a great variety of uses. A ceiling cornice made of this style of moulding gives a finished appearance to the ceiling and walls. This invention relates more to the method of carving or ornamentation than to the particular shape of the moulding, and the carving may be varied to adapt it to different forms of moulding.

BENJAMIN'S IMPROVED MOULDING.

Further particulars may be obtained by addressing the inventor as above.

THE STEAM ENGINE INDICATOR.

The steam engine indicator is designed to register automatically upon paper the pressure of steam in the cylinder at every point of the piston's stroke. The form of the diagram thus drawn by it affords information of a variety of facts not otherwise readily obtained. It is now generally conceded that the indicator is an invaluable appendage to the steam engine, and when properly applied and understood, cannot be too highly estimated. The efficiency and economy of every engine made or sold ought to be proved by the indicator diagram. In fact, no builders of first class engines now consider their canvass complete without showing a facsimile of the diagram of their engine.



CROSBY'S STEAM ENGINE INDICATOR.

Our engraving represents a Crosby indicator, which is probably the most perfect instrument of its class yet devised. The principle and action of indicators are so simple, and to most practical engineers now so well understood, that it will only be necessary to give the accompanying cut and description of the parts of this instrument to readily appreciate the advantages accruing from its use.

A is a case or jacket inclosing a cylinder, into which a piston is nicely fitted to move without friction; to the upper side of this piston is attached a steel helical spring, the upper end of which is fastened to the cap or head of the cylinder; to the upper end of the piston rod, B, is directly jointed the short lever, C D, whose short end is jointed to the head of a vibrating standard at D, and its long end is jointed to the long lever, E F, at the point, C. The long arm of the lever, E F, is jointed at its outer extremity to a second vibrating standard at E, and to the other extremity is attached the pencil, F. To the case, A, is permanently attached the horizontal plate, G, at one end of which is jointed a corresponding plate, H, situated above the former and carrying the revolving drum, covered by the paper cylinder, I. To this drum is attached a cord, wound around a groove at its base and carried by the guide wheel, K, between the two extra guide wheels, L and M; the guide wheels, L and M, are attached to the arm, N, which swivels around a point in line with the axis of guide wheel, K, and is held in its proper position by the thumb nut, O. The drum carrying the paper cylinder, I, is rotated in one direction by the tension on the cord, and in the reverse direction by the reaction of a spring inclosed therein; the tension upon this spring may be adjusted to suit by the thumb nut at the open end of the drum. The plate, H, carrying the drum and paper cylinder, is held away from the pencil, F, by a spring situated between the plates, H and G, directly in line with the axis of the drum, until the operator desires to take a diagram. By pressing upon the handle, P, the paper cylinder is moved forward and the pencil comes in contact with the paper. Immediately upon removing this pressure the paper cylinder automatically assumes its former position. Two adjustable stops determine the amount of this motion and regulate the force with which the pencil presses upon the paper, a hair line being attainable without friction. The bushing which carries the pencil is bored to receive a graphite or metallic wire, and is supplied with means for holding it in any position desired. The piston rod is bored at each end almost half its length, leaving a thin partition or stop in the center; the upper chamber is used as a reservoir for a lubricant, and is provided with pin holes close to the partition to allow the oil to flow out and down, and so lubricate the rod and piston; the lower chamber allows the steam to enter and warm the lubricant, causing it to assume a more limpid form and flow freely in cold weather. The piston rod is thus made lighter without weakening it materially.

The pencil in this indicator is situated close to the piston rod, instead of projecting several inches to one side, as in other instruments of this class, and the paper is moved up to the pencil, instead of moving the pencil up to the paper, as heretofore. The parallel motion is new and perfectly true. There is a hot air chamber or jacket around the steam cylinder instead of steam chamber.

It is claimed that this indicator is free from some very objectionable features prominent in other makes. Friction always causes errors in registration, but at the same time it admits of drawing the diagram even and smooth, and deceives the operator into the belief that he has got a good diagram, while the reverse is true.

The manufacturers of the Crosby indicator have aimed by all possible means to avoid friction. The motion of the pencil in this indicator is always a uniform multiplication of the piston motion. The weight of reciprocating parts is reduced to the minimum, and the parts which require constant lubrication, such as the cylinder, piston, and rod, are automatically oiled.

This instrument is more easily operated than indicators in which it is necessary to be to some extent an expert, with a delicate sense of touch to determine just the proper force to employ in moving the pencil against the paper so as not to tear it or cause undue friction. In this indicator all this is pre-arranged so accurately that it is said a child can operate two indicators—one at each end of the engine cylinders—simultaneously, without difficulty, and obtain hair lines without friction. When properly adjusted, connected, and operated, diagrams made by this instrument may be implicitly relied upon. For further information address the Crosby Steam Valve and Gauge Co., corner Milk and Batterymarch Streets, Boston, Mass.

Novel Use for Empty Cans.

The works of the Duquesne Smelting Company—a Pittsburg enterprise—are located at the mouth of Sacramento Gulch, near Leadville, Col. A few weeks ago Superintendent Tate ran short of ore suitable for "flux," and was saved a great deal of worry by the proximity of an immense deposit of empty tin cans. Canned fruit, meat, and vegetables, it should be stated, are the mainstay of Colorado cooks. The back yards and waste places about Leadville are covered with millions of empty cans of every form and size. Superintendent Tate ordered a squad of Chinamen and two big charcoal wagons to the can pile, and soon had his smelter running on ore and tin cans. The latter supplied the needed elements, and the Duquesne will not run out of "flux" while there is an empty can in Leadville.

Patent Office Items.

Mr. Edison has just obtained a new patent for improvements on his original phonograph, by which the machine is made to speak to better advantage than ever before.

A machine for making pies has lately been patented. This, taken in connection with the patent substitute for eggs, will be good news for boardinghouse keepers.

After a long contest with many other claimants, Mr. Emil Holtzmann, of Germany, has received a U. S. patent for the copying process now so extensively used, by which many copies of letters are taken from a sheet of soft glue. The patent is dated May 18, 1880, No. 227,629. It was patented in Germany in 1878.

Correspondence.

Fungi on Glass.

To the Editor of the Scientific American :

In the last SCIENTIFIC AMERICAN I saw an account of "Household Fungi," said to be found on glass, exhibited at the Microscopical Club of Buffalo. As I have made glass a subject of study for about twenty years, and entered a glass store as a boy forty years ago, I am desirous to know more about the glass referred to. I never saw or heard of any "fungus" on glass, but I have often seen what we call rust or stain on the surface, and that is, I think, what was observed. It is an efflorescence upon the surface occasioned by an excess of soda or potash in the composition of the glass. It can be removed from the surface by the skillful use of hydrofluoric acid.

The reason why similar appearances were found on glass in other places is that it was probably of the same kind, having an excess of uncombined alkali, which, having an affinity for moisture, effloresces and forms a coating which can only be removed by acid. If it were indeed a "fungus," I think it could be easily removed by soap and water. That it could not be thus removed proves conclusively to me that it was the ordinary rust or stain, which so frequently troubles the glassmakers. If it be rust, it is no new phenomenon, but one which is noticed on all the old Greek and Roman glass exhumed from the ruins of old cities, whose iridescence charms us in the museums of Europe and America; and this same rust has often been removed from the windows on which it has appeared in public and private buildings, by workmen in my own employ, by the skillful use of acid. This stain, in some cases, presents such peculiar shapes and colors, that it has given rise to all of the ridiculous stories of portraits of deceased friends impressed upon window panes by the action of lightning.

Boston, May 18, 1880. THOMAS GAFFIELD.

[Prof. J. W. Ward, to whom Mr. Gaffield lately wrote, substantially as above, informs us that, in view of Mr. G.'s suggestions, he has re-examined his patches of fungi, and is satisfied of their vegetable and superficial nature. But the statement in regard to their removal he thinks is a little too strong. They do in fact defy the action of soap and water; but rubbing with a pine stick and subsequent polishing with a cloth will, says Prof. Ward, remove them completely and leave no trace behind. Prof. W. thinks that the rust mentioned by Mr. Gaffield is not very often seen except by close observers like himself.—EDS. SCI. AMER.]

Fungi on Glass.

To the Editor of the Scientific American :

In the paragraph on page 320 of your journal for May 22, 1880, making mention of my note on a curious fungus discovered on some picture-covering glasses hanging on the wall of my house, there is a little inaccuracy, which, of course, is not chargeable to you, but to the reporter who collected the item for his journal. I exhibited the fungus, which covers several similar glasses in my sitting room, as a curious production; and after making some remarks on its peculiar characters, said further that I had noticed another but *different looking* fungoid growth occurring in somewhat similar spots scattered over the glass in the windows of the Grosvenor Library. Prof. Kellicott stated he had seen what *might be* the same thing on the windows of the Central School and City Hall.

My suggestion in relation to *these* growths, that is, such as were discovered on the windows of these public places, was that they might be due to human exhalations or confined breath; that those found on the glasses in my own house, which were *quite different* in form, had such an origin, I particularly stated, I did not feel satisfied, though it might be possible. I am not prepared to name either of these fungoids. That found on the windows of the library is small, yellowish-gray in color, densely arachnoid, with a distinct annular boundary, and variable in size. The one in the dwelling room belongs to the group of white rusts, *Perisporiacei*, something like an *Erysiphe*, but still more regularly defined, and without a nodular center. It is radial, dichotomously branching, white, circular in outline, the dichotomous terminations of the branchlets free, the whole flatly adherent to the glass, the surface of which it almost entirely covers with its thread like disks.

JAS. W. WARD.

Buffalo, May, 1880.

Seeing by Electricity.

To the Editor of the Scientific American :

Your article on "Seeing by Electricity" contained in the SCIENTIFIC of June 5, page 355, will prove of interest to many. Early in the fall of 1877, the principles and even the apparatus for rendering visible objects at a distance through a single telegraphic wire were described at No. 21 Cortlandt Street, in this city, to James G. Smith, Esq., formerly superintendent of the Atlantic and Pacific Telegraph Company, and now of the Continental Telegraph Company, I believe, and to Messrs. Shaw & Baldwin, telegraph constructors, also, I believe, now connected with the Continental. At that time I was engaged in perfecting an autographic telegraph by which maps and pictures were daily transmitted by telegraph over a single wire.

The recent announcements of this discovery in three different directions, each undoubtedly independent of my own experiments, show how the same idea often occurs in separate minds. There is no likelihood of any plan of this kind ever being reduced to practice, for some of the difficulties in the way of all of the plans are insuperable, as will be apparent from the following reasons:

1. The action of light upon selenium in changing its electric conductivity is slow; although new discoveries may remedy this feature.

2. To convey with any accuracy an image, one even so small as to be projected upon a square inch of surface (I am speaking now of the apparatus you describe), would necessitate that this surface should be composed of at least 10,000 insulated selenium points, connected with as many insulated wires leading to the receiving instrument; for the variation of the one-hundredth of an inch either way will "throw a line out of joint."

3. The most delicate apparatus would not indicate a change in resistance by the projection of light upon merely a selenium point.

4. Isochronism is unattainable, as required. The method I proposed involved the isochronous movement of the separate instruments. The transmitter consisted of a coil of fine selenium wire in a darkened case, having a diameter of say three inches. Light from the image to be transmitted was to be let into the chamber and upon the selenium coil by a fine tube which, starting at the periphery of the circle, would draw concentric imaginary spiral lines until reaching the center of the circle. Thus light emitted or reflected from the image to be transmitted would affect the selenium just in proportion to the brightness of the image at the different points within the compass of the circle traversed by the imaginary lines drawn by the opening in the tube. The speed of motion of the tube was to be such that in describing all the spiral lines from the periphery to the center of the circle, the impression made upon the retina while at the periphery of the circle would not have ceased until the light ray should have reached the center of the circle.

The receiver consisted of a darkened tube, having an inside diameter of three inches (corresponding to the transmitting circle), with its sides and bottom absolutely black. In this tube, describing imaginary lines just as the tube in the transmitter, was a blackened index carrying two fine insulated platinum points very close together connected with the secondary wire of a peculiar induction coil, the primary wire of which constituted a part of the main wire leading to the transmitter.

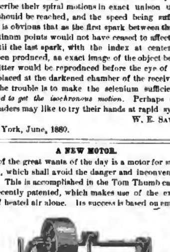
The transmitting ray of light and the invisible index in the darkened receiving tube were to start at the periphery and describe their spiral motions in exact unison until the center should be reached, and the speed being sufficiently great it is obvious that as the first spark between the receiving platinum points would not have ceased to affect the retina until the last spark, with the index at center, would have been produced, an exact image of the object before the transmitter would be reproduced before the eye of the observer placed at the darkened chamber of the receiver.

But the trouble is to make the selenium sufficiently active, *and to get the isochronous motion*. Perhaps some of your readers may like to try their hands at rapid synchronism. W. E. SAWYER.

New York, June, 1880.

A NEW MOTOR.

One of the great wants of the day is a motor for small machinery, which shall avoid the danger and inconvenience of steam. This is accomplished in the Tom Thumb caloric engine, recently patented, which makes use of the expansive force of heated air alone. Its success is based on employing



THE TOM THUMB CALORIC ENGINE.

a comparatively low temperature—250° to 300° Fah.—producing a pressure of four to five pounds per square inch, and operating on a broad diaphragm piston of relatively short stroke. The piston is formed of two circular metallic disks, having between them a flexible diaphragm composed of a layer of vulcanized gum elastic sheet, and over this externally a layer of canvas, which protects the gum and prevents it from yielding to pressure. A clamp ring attaches this diaphragm air-tight to the rim of a dish-shaped vessel, so as to allow of a motion in the piston to the extent of about one-third its diameter. This is the working cylinder, from which, it may be observed, the boring and fitting, as well as friction incident to the ordinary arrangement, are quite eliminated. The piston box forms the upper member of the machine, the connection of piston and crank being apparent in the engine. The central part, the heater, is a tight metallic box, the interior heating surface of which is greatly increased by numerous thin plates or ribs cast in connection with the bottom and rising almost to the top nearly the whole length. The heat being applied to the bottom of the box, the lower edges of these ribs are virtually in the fire, and thus the whole are readily kept at a suitable temperature.

At the bottom is another piston box similar to the first, but larger, and having its piston below, with a valve in it opening inwards. This is the air pump, and it is connected with one end of the heater by a pipe which has an automatic valve at the lower end, opening upwards. As this piston descends it fills the box with air, which in ascending is forced into the heater, and the valve in the pipe prevents its return. The other end of the heater is connected with the upper piston box or motor by a pipe always open, the two thus forming one chamber.

The operation of the machine is thus: The heater being filled with expanding air, the motor piston is forced upward, and just before it reaches the highest point a tappet on one of the cross head guides raises a lever, pivoted on the outer frame, which lever in rising forces open a valve in the bottom of the motor box, opening a communication with the outer air, and consequently the pressure subsides, allowing the piston to descend. Soon after the main crank passes the top center two long cranks on the ends of the shaft, connected with the crosshead of the lower piston by slotted rods, suddenly collapse the air pump, blowing out the hot air from the heater and motor box through the now open valve in the bottom of the latter, and supplying its place with fresh cold air. The motor piston now descending presses and closes the latter valve, and the fresh air is confined between it and the valve below the heater, to be at once expanded for another stroke. The action of the air pump not being against any pressure, little power is consumed in it. Like other caloric engines, it is single acting, and the pulley serves also for a flywheel. The internal capacities of the air pump and heater are equal, and about three times that of the motor vessel. This is important in order to obtain sufficient pressure at a temperature so low as not to injure the motor diaphragm—the gum being vulcanized to bear about 300° Fah. The simplicity and chapness of construction of this machine will recommend it for a great variety of purposes. An engine suitable to propel a sewing machine is about twenty-five inches high by thirteen wide, and heated by an oil or gas stove. An engine forty-five inches high is a quarter horse power, while the full horse power is six feet high by three feet wide.

For further information address J. Jenkins, No. 3 South Tenth street, Philadelphia, Pa.

MISCELLANEOUS INVENTIONS.

Mr. Francis Law, Sr., of East Orange (Bloomfield P. O.), N. J., has patented an improved hat-flanging machine, so constructed that the sand weights can be conveniently raised and lowered upon the flanges to press the brims of hats. The invention consists in constructing a hat-flanging machine of a frame having table and bench, a suspended sand weight, a carriage and track for carrying the sand weight, uprights, and a treadle for raising and lowering the sand weight.

An improved breech-loading firearm has been patented by Mr. George H. Fay, of Morrison, Ill. This invention relates to improvements in firearms composed of a number of fixed barrels, and to the mode of firing the arm; and the object of the invention is to give a wider range to the arm, and thus increase its effectiveness; also to arrange the firing devices so that all of the barrels may be fired simultaneously, or singly.

Mr. James O. Hands, of Louisville, Ky., has patented a novel device for automatically delivering coins for the purpose of facilitating the ready making of change. The invention consists of a box or case containing a number of receptacles for holding coins of different sizes, of automatic devices for delivering the coins and sounding an alarm as each coin is delivered, or as the drawer is opened, and of novel devices for locking the drawer and the delivery slides.

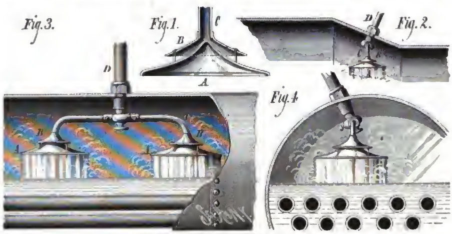
Mr. Samuel M. Kohr, of Omaha, Neb., has patented a new butter package for transportation and handling butter conveniently. The invention consists of a pail containing a series of crates, formed of a number of cups for receiving the rolls of butter, mounted above each other upon a central rod in the pail.

Mr. Peter W. Nelson, of Moline, Ill., has patented a device of especial convenience to shopkeepers, whereby barrels of groceries or other articles may be supported and readily swung in and out under the shop counter. The invention consists of a vertical bar having at each end a laterally extending hook or clasp, the upper hook or clasp being vertically adjustable, said bar being pivoted above in the under side of the counter, near its edge, and below in the floor, so that it can be turned outward to receive a barrel between its hooks or clasps and be swung around to carry the barrel under the counter.

A USEFUL STEAM BOILER APPLIANCE.

Aside from defects in the construction of boilers, undoubtedly the greatest source of expense and danger is the accumulation of sediment and incrustation on the heating surfaces; and while special preparations in some instances prevent the accumulation of scale, the use of such preparations is, to say the least, inconvenient, and, as a rule, they make the water in a boiler to all appearance dirtier than it could be made by natural causes.

Our engraving illustrates a device which obviates the difficulties arising from the use of bad water, by precipitating the mineral salts and other impurities in the feed water before it joins the body of the water in the boiler. This important result is secured by allowing the water to enter the boiler through the steam space in a thin sheet or spray, which is instantly heated to the boiling point, precipitating the impurities before it reaches the surface of the water contained by the boiler. The precipitate goes immediately to the bottom of the boiler, whence it is removed by blowing out two or three times daily. This is a new departure in steam engineering, and it is looked upon with some suspicion on the part of steam engineers who have never investigated the subject, but actual experiment has proved that no more loss is experienced in introducing feed water in this way than any other, while the advantages attending this method are very great.



MOREHOUSE'S ANTI-INCRUSTATOR.

The device by which water is introduced into the boiler is clearly represented in the engraving, Fig. 1 representing the peculiar nozzle for spreading the water injected into the boiler; Fig. 2 shows the application of the device to a locomotive boiler, and Figs. 3 and 4 are respectively longitudinal and transverse sections of a cylindrical boiler provided with the anti incrustator.

The water distributer consists of a conical plate, A, suspended beneath the flaring end, B, of the pipe, C, by three bolts, which may be adjusted so as to vary the distance between the plate, A, and the flaring pipe end, B, and thus regulate the amount of water entering the boiler. The inventor prefers to arrange two water distributers as shown in Fig. 3, the two pipes, C, being connected with a T whose shank projects through the boiler shell and connects with the feed pipe, D.

With this device, either hot or cold feed water may be used. Among the many important advantages arising from the use of this improvement, the most prominent are, the entire prevention of scale, the absence of foaming or priming, and the obviation of that class of injuries to boilers resulting from the contact of cool feed water with hot iron surfaces.

Further information concerning this useful invention may be obtained by addressing the patentee, Mr. Wm. Morehouse, 147 Mariner street, Buffalo, N. Y.

NEW CEILING AND WALL.

The ordinary method of lathing and plastering the ceilings and interior walls of buildings consists in nailing wooden laths to the joists or studs, then applying two separate coats of mortar; and, lastly, a white coat or "finish," composed of slaked lime and plaster of Paris, the latter being put in to give strength and solidity to the work. This method is objectionable on account of the time required for each coat to become dry before the succeeding one can be applied, and the mortar is liable to crack and become detached; and the inflammable character of the lath is another objection to this method.

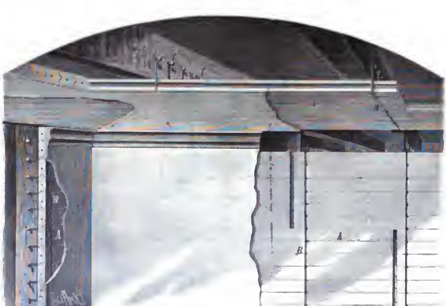
Our engraving shows a novel lath recently patented by Mr. Walter J. Garvey, of 407 Chestnut street, St. Louis, Mo. This lath consists of a bar of plaster of Paris cast in a mould around a stiffening and strengthening wire. The edges are tongued and grooved so that the entire series of laths may be locked together. These laths are made in lengths of 12, 16, 32, or 48 inches, as may be required. In width they may vary between 1½ and 2 inches.

Referring to the engraving, the laths, A, are secured in place by wires, B, looped over nails driven into the sides of the joists or studs. The contiguous ends of the laths are separated a short distance, and the intervening space is filled with plaster, making a smooth joint and at the same time fastening the laths by enveloping the wire core which is allowed to project beyond the end of the lath. As soon as the laths have been thus applied and fastened the white plaster coat or finish may be at once put on, when the work is complete.

This style of wall and ceiling may be made much quicker than by the ordinary methods, thereby saving three fourths of the time required to finish the walls of a house, and when done it is harder and more durable than ordinary lath and plaster walls and ceilings, besides being entirely fireproof.

The inventor informs us that this wall will not crack, as its peculiar construction admits of considerable change in the frame of a building without affecting the walls.

The lath may be manufactured where it is used, or it may be readily shipped to any point where needed.


GARVEY'S LATHING AND PLASTERING.

ENGINEERING INVENTIONS.

Messrs. Gustav Ripp and John Mueller, of Jersey City, N. J., have patented a new and improved automatic apparatus which will shut off the motive element from the engine in case the belts or machinery break or become disordered.

Mr. John H. Gable, of Shamokin, Pa., has patented an improved pipe cleaner for cleaning deposits of sediment from the inner surfaces of the column or pump pipes of mine shafts and slopes, and for cleaning out other pipes. The invention consists of a pipe cleaner formed of a cylinder or frame provided with cutters to loosen the sediment, wheels to crush and pulverize the sediment, and a brush to sweep the inner surface of the pipe.

Mr Orlo H. Drinkwater, of Cedar Point, Kan., has invented a car coupling which consists mainly of a draw bar having a hook or shoulder and a link or clasp, which is pivoted and adapted to receive and lock with the shoulder or hook of a draw bar attached to the opposite car. The links or hinged clasps are held engaged with the respective draw bars by means of a spring or other suitable devices, and may be opened to allow uncoupling by means of rods, levers, or other means. The hinged loop or clasp is held open by a spring catch until the latter is acted on automatically, thus causing it to release the clasp.

IMPROVED MILL PICK.

The annexed engraving represents an improved mill pick patented by Mr. Edgar F. Lemoine, of Emmerton, Va. The novel feature of this pick is the employment of a thin blade tempered throughout its entire length, and capable of being entirely used up without forging or retempering. The invention consists in a pair of serrated clamping jaws, which receive the thin picking blades, the latter being provided on their inner ends with two or three ratchet teeth for engaging the serrations of the clamping jaws. The outer jaw is perforated with a screw threaded hole for receiving the threaded portion of the handle; the inner jaw has a plain hole through it fitting the plain portion of the handle. By turning the handle, by means of a lever or wrench, the jaws are brought firmly down upon the picking blades, which are as efficient as if they were an integral part of the jaws, having the advantage of being adjustable as they become worn.


LEMOINE'S MILL PICK.

The inventor proposes, in some instances, to put ratchet teeth only on one side of the blade, when two blades may be placed in each jaw.

The jaws may be conveniently used to hold the blades while grinding. This improved pick seems to possess many advantages over the ordinary form, it is easily kept in order, and is much cheaper, if the expense and trouble of sharpening and retempering are considered.

Railways and Population.

A table constructed by Prof. Stürmer, of Bromberg, shows the length of railway in several of the chief countries of the world and its proportion to the population. In Europe, on the average, there are 4·9 kilometers of railway to every 10,000 inhabitants. Greece has the least proportion to the population, having only 0·08 kilometer to every 10,000 of the population. Next comes Turkey, with 1·6; Portugal, 2·3, Roumania, 2·4, Russia, 2·8; Italy, 2·9; and so upward in the scale, France having 6·3; Germany, 7·1; Great Britain, 8·1; and Sweden heading the list with 10·8, though its total mileage is not a fifth of that of Great Britain. In Asia it appears that only 0·16 kilometer is averaged to every 10,000 inhabitants; and in Africa the proportion is only 0·17. In the United States the proportion is heavy—32·9 to every 10,000 of the people; while the whole of America has the average of 17·2, and in Australia the proportion is already 10·6. The thinly-peopled countries, the *Pall Mall Gazette* remarks, necessarily come to the front in this instance; but the table is of some interest as showing the effect of a large or small length of line in effecting

comparisons of this nature, and also in indicating the comparative density of population to that of the facilities for its conveyance by rail.

THE CRINOIDS OF CRAWFORDSVILLE.

BY M. C. HOVEY.

The rocks of Indiana are generally hidden by heavy drift and lacustral deposits. Their nature and contents are ascertained by the exposure of strata along the line of streams, and more recently by quarries, mines, and other artificial excavations. Of the latter there were few in those early days when Prof. E. O. Hovey—for whom, in behalf of science as well as from filial regard, a place is claimed among the pioneer geologists of the West—began to explore the resources of that region. The extensive cabinet of Wabash College is a memorial of his diligence; but those who admire its specimens can hardly realize the weary rambles on foot and hazardous voyages by raft or canoe by means of which many of them were secured.

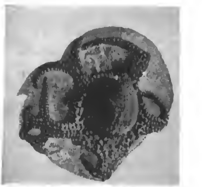
Here and there, along Sugar Creek, as it cuts its way through the woodlands and wheat fields of Montgomery county, my father discovered, as early as 1836, banks made up of rings and stems mingled with shells and geodes. Public attention was first called to these singular deposits in Owen's preliminary geological report (1838), on account of their economic value as material for the manufacture of lime. He merely says: "Four miles below Crawfordsville, at the mouth of Anfield's Creek, a stratum, some four to eight feet thick, of encrinital limestone is exposed." The next notice taken of the locality is in Lawrence's manual of the "Geological Formations of the Western States" (Boston, 1843), in which he speaks of it as exceedingly rich in encrinites. "Here," he says, "the finest specimens in the country are obtained, both on account of their size and beauty." I doubt if either of these gentlemen did more than make a flying visit to those crinoid banks, or saw anything better than the rings and stems referred to above.

Organic remains, such as those now described, both interested and puzzled scientific men long before their true nature was discovered. Three hundred years ago curiosity-hunters in Europe found pebbles impressed with star shaped figures, and called them "trochites." At first they were regarded with mysterious awe; and it was doubted whether they were crystals, petrefactions, or elfin charms. Certain flower-like impressions were afterward found on the rocks, which were called "encrinites," or stone lilies. The long stems and feathery corona of these mimic blossoms deceived even the great botanist, Linnæus, who did not detect their animal nature. In A. D. 1755, a "marine palm" was found near the island of Martinique, which was described as such in the tenth edition of "Systema Naturæ," under the name of the *Pentacrinus asterias*. This is now regarded as the typical crinoid.

Cuvier saw the truth that had escaped others, namely, that the Pentacrinus, instead of being a plant, was an animal, "a star fish with a stem;" and that the encrinite was its fossil representative, of which the trochites were only fragments. At a still later day the name "crinoidea" was given, by J. S. Miller, to include the entire order. In common parlance at the West the term encrinites has been given to the fragmentary stems, while that of crinoid has been reserved for the flower-like head growing at the upper end of the stem. For reasons that will appear more fully in the course of this article, we know that, where the former are most abundant the latter are rare, and indeed they are now sought in an entirely different stratum.

In the summer of 1842, a New York collector advertised for encrinites, offering to pay $5 a bushel for them on delivery. What a chance for a boy nine years old to earn pocket money! I forwarded a bushel of the stems at once, and told him he could have more at the same rate; but he sent word that the market was supplied! While filling this order I picked up a pebble wholly unlike anything previously found in the region, and prudently retained it for my juvenile cabinet. It was covered with warty protuberances, and hence was identified by the rustics as a "petrified toad," by the same process of guesswork that led them to describe the stems as petrified snakes, and the rings as Indian beads. But my specimen was really a weather-beaten *Actinocrinus*, and was probably the first true crinoid ever found in the Crawfordsville banks, whence thousands have since gone to adorn public and private cabinets in this country and in Europe. The locality where it was obtained is now called Corey's Bluff, and is about six miles above the spot mentioned by Owen. Other crinoid banks were also explored—at Remley's Ford, Island Ford, Indian Ford, and on Walnut Fork, Black Creek, and other tributaries of Sugar Creek. By diligent search, additional crinoids were found, and of greatly diversified peculiarities. They are referable to what is now known as the Keokuk group, forming part of the broad belt of sub-carboniferous rocks that sweeps entirely through the State from the Ohio River to Lake Michigan. To the early geologists, however, who cautiously felt their way along the path of science, it was simply known as "Formation No. 8," and its fossils likewise were for the most part merely numbered, except in cases where well ascertained distinctions warranted an attempt at classification by names. My father published several articles bringing the crinoid banks of Indiana to the notice of the scientific world; but he left the task of describing new genera and species to those whom he regarded as more experienced palæontologists.

As recently as 1848, the only books in existence devoted exclusively to the subject of crinoids were the monographs of Miller and Austin, treating wholly of those that had been found in Europe. Numerous papers on the subject had appeared, however, some of them dating back to the last century; but these were scattered through various scientific works with which Indiana libraries were at that time scantily supplied. New contributions to crinoidal literature have been made since then in profusion, especially in connection with the elegant volumes embodying the results of geological surveys in many of the Western States, until now it is



GONIASTEROIDOCRINUS TUBEROSUS.—(Natural Size.)

said that three hundred and eighty naturalists have written on crinoids, and that their productions would fill a library by themselves!

Agassiz, in his "Methods of Study," skillfully and at considerable length, traces the homology of the echinodermata; showing that the star fish, sea urchin, serpent star, sea cucumber, and sea lily (crinoid) are but modifications of one persistent creative idea.

Haeckel exalts the Echinodermata from being, as in the Cuvierian system, a mere class of the Radiata—the lowest sub-kingdom—to an honorable rank as one of the seven chief tribes into which he divides the animal kingdom, and only the third below the Vertebrata. He also arranges the crinoidea in three families, namely, those having arms and stems (brachiata); those that are nut-like (blastoidea); those that resemble little sacs or pouches (cystidea). The Indiana crinoids are mostly brachiata, but the other two families are represented.

The anatomy of the crinoid presents certain remarkable features, to be described as follows:

Fig. 2.—ONYCHOCRINUS EXCULPTUS.—(Natural Size.)

1. *The Root.*—The comatula, and other free crinoids, have mere tufts of cirri, whereby to grasp sea weeds or any other support, or else to anchor themselves on muddy bottoms. They can free themselves at pleasure and either swim or float away elsewhere. But the fixed crinoids have stout, jointed, branching roots, some of which look like the stumps of diminutive oaks. These may grasp branches of coral, and the stems of other crinoids, or they may spread wide ramifications on the mud of the sea floor. Other roots are formed by a simple enlargement of the lowest ossicle of the stem, cementing it by concentric layers to a ledge of rock, whence the plant-like animal rises amid the waters. There are specimens in the Harvard Museum, in which this is reversed; the roots clinging to lignite, showing that these crinoids, which are from the Tertiary, originally hung down from floating blocks of wood.

2. *The Stem.*—This is a series of flat, calcareous rings, uniting to form a tubular column that rests on the root. The shape often varies, even in a single stem, making the identification of fragments difficult. The cyclindrical form prevails, but many are oval or pentagonal. The canal generally, but not always, conforms to the exterior. The rings are in some specimens extremely thin, while in others they are a quarter of an inch thick. They break with a crystalline fracture. The softer parts, not being capable of petrifaction, have disappeared; but it is supposed that in the living animal the joints were held together by fibers running lengthwise of the stem, and also by an integument. The canal was filled with gelatinous substance. The articulations of the disks usually radiate in fine lines from the canal outward, but in the curiously twisted stem of the *Platycrinus hemisphericus* a ridge coinciding with the long axis of the oval joint takes the place of these lines. This beautiful species has also two spiral rows of tendrils along a portion of its stalk, each joint furnishing a pair. In other varieties the tendrils protrude singly or in pairs, or in whorls of threes, or even fives. I have seen fifty successive rings without a tendril, and then one will shoot out of great relative size, spanning five or six rings at its base. Some stems are smooth, faintly marked cylinders; others are grooved, fluted, bead-like, moniliform, or decorated with spines and knobs. Usually they are broken up into pieces from one to five inches in length. But they often are much longer, and one was measured at Island Ford that was six feet long as it lay on the ledge. They vary in diameter from one thirty second of an inch to an inch or more. Tablets of encrinital limestone are to be seen where they lie in coils and knots, cemented to the stone, with here and there a head in bass-relief.

3. *The Head.*—Every stem is fairly entitled to a head, but they are seldom found together. This is due partly to the existence of a peculiar split joint, called by Miller a "syzygy," not bound by muscles or fibers, hence easily snapped by a jerk, to free an entangled arm, that is afterward reproduced at leisure. Prof. Verrill states that living crinoids have to be taken with great care, and at once immersed in alcohol, or else they will literally fly all to pieces. This work of destruction is also aided by the natural decay of the membrane covering and holding together the whole body in life; whereupon the hundreds of calcareous plates fall apart. Hence good heads do not abound where the stems are best; but in beds of shale that was once mud, by which the animal was smothered and held while the stems, dismembered, sank down to a lower stratum. This is shown by a section of Corey's Bluff. On a floor of limestone rests a bed of blue shale, twenty-five feet thick, and almost completely made up of encrinite stems. Above this is a layer of gray sandstone, two feet thick, supporting a bed of softer shale than the first. Here the heads abound, being preserved as described. This is about five feet thick. Successive strata of sandstone, comparatively barren of fossils, rise for twenty-five feet, or to the soil. Thus deep and heavy excavations must be made in order to get at the fossiliferous horizon.

Inspection of a well cleaned calyx, or head, shows it to be built up of several series of plates. The lowest are the *basals*, being from two to six calcareous buttons resting on the terminal disk of the stem. Then come one or more circles of *radials* and *interradials*, uniting to form a visceral cup. The uppermost row is suitably beveled to receive the *brachials*, or arm plates. The primary branches are liable to repeated subdivision, until in some species there are from 80 to 100 rays, and the total number of plates exceeds 1,000, besides their fringe of graceful cilia. When the arms are expanded, or entirely removed, the close fitting ventral plates are seen. The stomach is supported, as it seems from the researches of Meek and Worthen, by a convoluted cylinder, resembling the finest lace. The proboscis, or chimney, is really an excretory tube, rising from the ventral plates, in some cases, till it protrudes beyond the arms.

Austin, Murchison, and others regarded crinoids as predatory creatures, crushing and devouring shell-fish. But observation of living species proves this to be an error. The animal sucks in through channels in its arms, tiny streams holding food in suspension or solution. These are poured into the stomach, sifted perhaps by the net-like apparatus described above; then when all assimilable matter is extracted the exhausted liquid is spurted through the proboscis to such a distance as to prevent its immediate return. The currents thus made drew in young parasitic shells, which they also fed by animalcula. The most common of these in former ages were the *platyceras*, scores of which I have examined without finding any evidence that they either devoured or were devoured by the host that carried them; yet the shell sometimes grew to such a size as to be a troublesome if not a fatal guest. (See Fig. 1.)

The entire number of crinoids secured by us, including purchases, was about 2,000; varying in size from the *Onychocrinus exculptus* (Fig. 2) down to the merest buds and sprays. The best were cleaned for the cabinet, many were disposed of by exchange; the remainder are stored in boxes.

It is estimated that more that 5,000 crinoids in all have

been found in the vicinity of Crawfordsville by various collectors, among whom should be mentioned Mr. C. Dyer, Mr. F. H. Bradley, and the Coreys. Corey's Bluff is now the property of Prof. D. A. Bassett, whose improved methods, both of quarrying and of cleaning, have gained admirable results. The removal of the incrusted shale is effected by brushes, graded awls, and needles, and requires a degree of skill. Some specimens are so tender as to crumble under the most careful handling; and others are so hardened by silex as to be refractory. But patient manipulation is usually well recompensed.

A complete list, so far as known, of the fossils of the Keokuk group at Crawfordsville, was prepared by my father in the last year of his life, and after due revision was published in the State Geological Report of Indiana for 1875 (pp. 376-381), together with valuable observations by Prof John Collett. From this catalogue it appears that twenty-seven genera and fifty-eight species of crinoids from that locality have been described by Hall, Meek, Worthen, and others, while several new species yet remain inedited.

Crinoids were the first of their class to appear in Paleozoic time. They became more scarce during the Mesozoic and Tertiary ages, until now they have mainly yielded the seas to star fish, sea-urchins, and other modern echinoderms. It may be that their luxuriant growth in the period before the coal formation was due to water saturated with carbonate of lime and resting under pressure of a heavy atmosphere. That they then grew in shallow water is evident from the relation of the crinoid banks to the coal beds rich in remains of terrestrial vegetation. Only six genera of stalked crinoids are now known to inhabit the whole ocean, and these are found at depths ranging from 3,000 to 15,000 feet! Though eagerly sought for more than a century only twenty specimens were found, until the number was recently increased by deep sea dredging, whose results have been given to the world by Sir Wyville Thomson, in the "Voyage of the Challenger" and "The Depths of the Sea."

It is said that in Agassiz's expedition last summer 300 specimens were taken. Possibly somewhere amid "the abyssal province," including 140,000 square miles, the explored portions of which are to be reckoned only by the square yard, regions may yet be found where these beautiful sea-lilies are as abundant as they were when Indiana lay at the bottom of the sea, and instead of fields of wheat and corn had only crops of coral and crinoids.

NEW INVENTIONS.

An improved attachment for carriages, which furnishes a convenient support for carriages, has been patented by Emma J. Osborne, of Easley, S. C. The invention consists in a slide in the floor of the carriage, at the rear thereof, which slide can be drawn out to carry the baggage, and can be pushed back so as to be out of the way when not in use.

Mr Martin J. Sunderlin, of Watkins, N. Y., has patented an improved apparatus for cleaning horses. The present invention is an improvement upon apparatus for which letters patent have been allowed to the same inventor, which apparatus consists, essentially, of a brush for cleaning horses, carriages, etc., a flexible pipe supplying water to the brush from an elevated or other source of water supply; and the object of the present improvement is to simplify and cheapen the construction.

An improved rubber bracelet has been patented by Mr. David Stone, of New York city. The object of this invention is to furnish rubber bracelets simple and inexpensive in construction and neat and ornamental in appearance. The invention consists in constructing rubber bracelets with extensions upon the opposite side edges of the band to represent buckles; also, in forming slots in the said extensions, and also in the combination, with the slotted extensions, of the cross bar placed upon the inner side of the band, with its ends projecting through the slots and resting upon the side extensions.

Mr. Abraham Van Winkle, of Newark, N. J., has patented a novel frame for anodes, the object being to prevent the falling apart of the particles or pieces of the anode after it has become disintegrated by the action of the electric current while hanging in the solution without substantially interfering with the exposure of the surfaces of the anode to the solution. The invention consists in combining a frame of wood or other suitable material, with the edges of an anode of cast or rolled metal.

Mr. Daniel Dunscomb, of New York city, has patented an improved cover designed especially for dredging boxes or for boxes intended to hold powders of any kind. It consists in a cover, preferably metallic, having a central aperture, and of a perforated metallic cap having a downward projecting notched elastic rim. This cap is removably fitted into the aperture of the cover.

Mr. Nathaniel Pyles, of 43 Canal street, Chicago, Ill., has patented an improved carpet and floor dust receiver. The object of this invention is to provide a dust pan or receiver that may be pushed along in front of the person sweeping by the broom as the carpet is being swept in the usual way, to receive all of the dust and dirt raised or swept up by the broom and carry it along until the entire floor has been swept.

An improved plow has been patented by Messrs Peter S. Swartz and Alexander Arnot, of Lexington, Mich. The object of this invention is to provide a double-ended plow so arranged that its movement can be easily reversed at the end of the furrow. The invention consists of a double-ended plow having the beam head, to which the beam and the handles are attached, pivoted to a plate on the upper edge of the land side in such a manner that the motion of the plow can be reversed by simply turning the handle and beam around the pivot, the body of the plow not being changed in its position.

AMERICAN INDUSTRIES.—No. 45.

THE MANUFACTURE OF AIR COMPRESSORS, STEAM ENGINES, AND PUMPS.—THE NORWALK IRON WORKS COMPANY.

A great deal of the success of some of the most difficult of modern engineering work has been due to the improved methods of applying compressed air to transmit the power required. By no other means at present known can the power obtained from steam or water be more conveniently stored and transmitted for use at long distances, so as to be readily applicable for all purposes. It was the expansive elasticity of air, condensed by the power furnished by a mountain stream, that worked the distant boring machines and removed the rock taken out of the St. Gothard tunnel; and compressed air was also said to furnish the lungs as well as the heart of the force required to prosecute this enterprise, as without the ventilation thus furnished it would have been not only tedious but almost impossible to make such an extensive excavation.

Probably one of the most economical, compact, and serviceable of the air compressors introduced within recent years is that made by the Norwalk Iron Works Company, at South Norwalk, Conn., whose establishment furnishes the subject of the first page illustrations of this paper. It is a steam engine and air compressor combined, the steam cylinder and two air cylinders being in line with each other, each stroke of the piston rod condensing air in the cylinders in both its outward and inward motions. One of the air cylinders is larger than the other, and here the air receives its first compression, after which it is forced into the smaller cylinder to receive the heavier compression. The heat developed by compression in this way is not so great as when the whole work is done in one cylinder, the air having time to cool in the intermediate pipes between the cylinders and while in contact with a very large cooling surface in passing under the water jackets of the two cylinders. The cylinders are strongly fastened to a long, heavy frame, which is bolted to a solid foundation, and two heavy fly-wheels give evenness and steadiness to the motion, a governor regulating the speed. By this arrangement of a compound compressor the power developed in the steam cylinder is so evenly applied in the reciprocating parts that the most economical speed of piston can be obtained. The air valves are placed in the cylinder heads, and the water for cooling the air while being compressed circulates around the cylinders in a jacket.

In the manufacture of steam pumps the Norwalk Iron Works have for many years held a leading position, and were in a measure the pioneers in the introduction of many of the most important modern improvements. They obtained the control of the "Earle" patents, and made many important improvements simplifying the mechanism, and increasing the efficiency and durability of the pump. To secure the latter point they obtained a patent for a changeable cylinder lining, in which the valve seats are of gun metal, fitted to gauges, so they can be quickly removed when worn out and new ones put in their places. This work can be quickly done without disturbing the pipe connections, and without material stoppage of any of the operations for which the steady working of the pump may be important. The composition lining is an important feature where a pump is to be used for corrosive liquids, since it resists corrosion much better than iron, and, the parts being interchangeable, it is but a short job at any time to make the pump practically "as good as new," and at small cost. At the time the company introduced these improvements they constructed new patterns throughout, giving their latest style the distinguishing title of "the Norwalk steam pump." These pumps are used for every variety of work, for boiler feeding, for fire purposes, for steamboats and factories, for oils, acids, sugar, liquor, chemicals, etc. Every pump is tested before it leaves the establishment. The department devoted to this work is shown in our illustration to the right at the top of the page.

The hoisting engine, shown in the engraving, represents one of the latest products of the Norwalk Iron Works Company in this department. It is simple in its parts, built with exceptional strength, and economical in its consumption of fuel in proportion to the power developed. The company also make horizontal stationary engines, several hundred of their manufacture being in use in different parts of the country. They have now running in their own establishment one of 75 horse power, which they built ten years ago, and which has been running ever since. It is almost noiseless in its operation, and the consumption of coal for the power required in the machine-shop and foundry, with that furnished for some other manufacturing operations on the premises, as well as steam for heating in the winter time, does not exceed an average of a ton and a quarter per day.

The general view at the center of the page gives a good idea of the extent of the establishment of the Norwalk Iron Works Company. The main building is 300 feet long by 100 wide, connected with which is an engine and boiler house, and at a distance of a foot is the foundry, 150 by 70 feet. They do business direct with their customers, from their place in South Norwalk, Conn., a siding from the New York and New Haven Railroad running direct to the works.

Going to a Fire.

One of the most exciting sights a stranger can witness in the lower part of New York is the fire department responding to an alarm of fire in the daytime. A representative of the *Fireman's Journal* describes a scene familiar to all our citizens, but one that many of our readers have probably never witnessed. We chanced to be in Broadway a day or two since, says the writer, when the street was crowded with vehicles of all kinds, and the sidewalks with a regular procession of pedestrians. Suddenly the gong of an approaching steamer sounded with its sharp, sudden, and continuous jingle; there was a rush of teams to clear the center of the street, and a rush of policemen to aid the drivers in getting their vehicles against the curb; then came a fireman running for dear life, shouting "clear the road," and right behind him came the steamer, the horses on the gallop, and a cloud of smoke issuing from the smoke stack a moment, and she was gone. Then came a hook and ladder truck, with sounding gong, horses on the jump, and the members of the company clinging to their precarious perches on top. Next came the Salvage Corps, gong sounding, horses running, and the men urging them as if their lives depended on their speed. It was an exciting event, lasting but a moment, but quickening to the pulse of the laziest on-looker. Thousands of persons had stopped to catch a glimpse of the passing firemen, and for over a mile Broadway was jammed with vehicles and pedestrians, all of whom had turned out to make room for the firemen, on whose speed might depend the property and lives of some of our citizens. To a stranger the sight must have been a thrilling one, and impressed him with the efficiency of our fire department. We know that to our soldiers the heavy rumble of the apparatus seemed like the movement of artillery to the front and to presage an impending battle. And so it was a battle—a fight between the trained firemen and an enemy as old as the earth or the heavens, and one that has scourged mankind since time was.

Improved Telephone Call.

The *Boston Advertiser* describes an improved telephone call signal, which is about to be introduced in that city It is not of application where a subscriber has a private wire, but is for use in the smaller cities where several subscribers are on the same wire, and, when one is called, all hear the bell, and each must have his separate call. It is a device by which only the person desired may be called and so, without any particular style of call, as at present, be known whenever he hears the bell that it is for him The apparatus is something like this: At the central office is a clock which regulates a clock in the office of each subscriber on the circuit, so that they all run in exactly the same time. This is done by setting the subscribers' clocks, so that what ever variation they have will make them faster than the central clock, and by a current of electricity they are made correct once in every minute. Upon the faces of these clocks and the central one is a dial around the second hand, marked off into as many divisions as there are subscribers on the wire. Whenever the second hand is in the division marked "1," the subscriber who has that number may be called and no other one will hear the bell. The same is true of No. 2 and so on around the circle. Suppose there are eight subscribers on the wire, each would have seven and a half seconds every minute in which he could be called—deducting a brief interval of silence at the beginning, which is given in order that the calls may not be mixed As two seconds is ample time for calling a person, it will be seen that there is a good margin allowed. The apparatus is simple. A wire extends from each clock to the central clock, and at each clock is an electric call bell. A single cell in the battery is used, which gives enough electricity to call one bell, but not two. The possibility of the invention turns upon the fact that electricity will take the shortest path possible. When the bells are silent the electric current is passing along a direct line of wire, but when the bells sound the current is passing through several hundred feet of wire coiled at the bell, which closes the circuit when the fingers press the key in the central office. This change in the circuit is made by a simple arrangement in the clock, by which a lever is thrown in one position or another, turning the current into the coil or sending it straight on. If there were enough electricity on, the bells would all ring, but only enough is generated to ring one bell, and that bell is the one which, for the time being, is affected by the electricity in its coil. Since only one coil is affected at one time, only one bell will ring, and when a subscriber hears it he is sure it is for him. Mr. George H. Bliss is the patentee, and the patent is owned by the Signal Telephone Corporation.

A Queer Water Power.

In the neighborhood of Argostuli, in the Ionian Islands, a water power is utilized in a peculiar manner. At four points on the coast, the sea, at its ordinary level, enters a very narrow creek, or broken rocky channel, and after running somewhat rapidly through this channel and among broken fragments of rock, for a short distance, it gradually becomes sucked into the earth and disappears. By conducting the water through an artificial canal for a few yards, and so regulating its course and forcing all the water that enters to pass in a single stream beneath an undershot wheel, power enough is obtained in two cases to drive a mill. Mills have, in fact, been placed there by an enterprising Englishman, and are constantly at work. The stream, after being utilized, is allowed to take its natural channel, and is lost among the rocks.

PORCELAIN CHIMNEY-PIECE.

Our engraving shows a chimney-piece, standing about twelve feet high, constructed entirely of hard and soft porcelain by the Rörstrand Company, Limited, Sweden. Its general color is lavender and celadon, picked out with gold, but there are other colors blending with these and making a harmonious whole of great delicacy and richness. The fireplace is surrounded with a beautiful border of flowers and leaves in white porcelain picked out with gold. The columns on either side are divided into plain panels of lavender and gold, separated by richly ornamented medallions. Above the columns is a frieze with scroll work of singularly beautiful design in celadon, lavender, and fine tracery in gold, while above that again is the white porcelain shelf, resembling in its purity and polish the richest marble. Above this, in the center of a long horizontal panel ornamented with an elegant scroll pattern in relief, is a charmingly modeled figure of Cupid, in the round, a most beautifully executed porcelain. Just over the Cupid, in a niche prepared for it, is an Etruscan vase standing some three feet high. The design and coloring of this vase may be said to be the *motif* for the rest of the chimney-piece, which is, so to speak, built up around this central figure. On either side of the vase are columns, banded into diamonds below, and ornamented above with medallions containing the insignia of the arts and sciences. The whole space between the niche and columns is filled with scroll work, highly elaborated, yet of the most chaste design. The upper part of this superb work is in harmony with the richness of its lower portion. While the ornamentation is equally elaborate, it is lighter in color and treatment, and gives an effect of finish which is altogether satisfactory. Whether in this piece we consider the adaptability of the material to the use proposed, or the character of the ornamentation allowable in an object of this kind, or simply the effect of the whole as we see it, there can be but one opinion of its merit: its purity and harmony of design are admirable.

History and Antiquities of Arizona.

The early history of Arizona has still to be written, but it is in most respects identical with that of Southern California, New Mexico, and Northern Mexico. That the original inhabitants belonged to the same civilization as that under which Mexico rose to so comparatively high a grade long before Cortes landed on its shores, is usually conceded, but whether the bulk of the people removed southward toward the consolidated empire of the Aztecs before the conquest of Mexico by the Spaniards; whether they remained and were swept away by the Spanish invasion from the south; or whether the Apache from the north drove them out of the open lands into the recesses of the cañons, and finally extinguished all but the few pueblos still remaining, is not certainly proven.

Probably the truth lies between the three opinions, and all the causes may have contributed to the depopulation of the country and to the ruin of the extensive cities, dwellings, canals, etc., which strew the plains and line the sides of the cañons. To the student of history nothing in Arizona equals in interest these architectural remains. Now that the railway is finished, many of these are comparatively accessible—the famous Casa Grande being only a few miles from the station of that name, while numerous other ruins exist in the districts around Florence and Phœnix.

A few miles from Phœnix are the ruins of two or three towns and the remains of two stupendous canals, one of which is forty feet wide, and in former times drew its supply of water from the river near the mountains, twenty miles distant. In this neighborhood are also the ruins of a building occupying a parallelogram of twenty feet by one hundred and thirty, with walls still over ten feet high. At from twelve to fourteen miles of Phœnix, at La Tempe, are remains of what must have been a populous city, and also another system of canals and reservoirs. Ruins of a similar description to those of Casa Grande have been found in the Rio Verde valley, on Pueblo creek and at Aztec pass.

Casa Grande, discovered by Father Kino, three hundred years ago, is situated near the Gila, a few miles from Florence. The main building is about fifty-five feet square, and four stories in height, with traces of two more stories. Each story contains five rooms, two thirty-five by ten feet, the other three twenty-four by nine feet, and all of them nine feet in height. The openings which once served for doors are three feet and one half high, two and one half feet wide at the base, and two feet wide at top. The whole of the interior is neatly plastered, the plaster perfect as when first put on. This building is surrounded by a wall, which, when perfect, was perhaps fifteen feet high, and six feet thick at the base, and within this are several smaller apartments, besides a sort of watch tower at the southeast and southwest corners.

The towns of the Moqui and Zuni, the former in the north of Arizona, and the latter just over the border in New Mexico, are in so many respects similar to the ruins scattered on plain and cañon, that they evidently belong to the same civilization; but whether the Indians are the remains of a separate tribe, or the remnants of many tribes, is one of the problems of the history of America.

In the Gila valley, one hundred and twenty miles from Tucson, are the famous Piedras Pintadas. A heap of rocks, about fifty feet high, is covered with rude figures, geometric, comic, anatomical. Here are squares, circles, crosses, triangles, snakes, toads, and vermin; men without heads and dogs without tails. The sketches show considerable similarity to the Aztec Calendar Stone in Mexico. It is a tradition with the Indians that those stones were put there in the time of Montezuma to record treaties between different tribes.

The "Indians" of Arizona evidently belong to several very different stocks. The wild Apache, formidable for his stealthiness and treachery more than from his numbers; the peaceful, not easily provoked, yet brave Pima; the industrious Papago, and the town-dwelling, family-loving, orderly, clean, and self contained Moqui, have little in common.

The distance which separates the rude Apache from the Moqui, with his old and respectable civilization, is as great as that between the rude tribes of Siberia and the cultivated Japanese.

The ruins in the cañons, on almost inaccessible terraces, are believed, by Major Powell, to be more recent than those of the plains. He believes the people took refuge there to escape the Spanish incursions.

PORCELAIN CHIMNEY-PIECE.

THREE blow-flies with their descendants will devour the body of a dead horse as quickly as will a lion.—*Linnæus.*

Prehistoric Treasures of the Pacific Coast.

The Pacific coast, from Alaska to the Isthmus of Panama, is rich in vestiges of prehistoric races. Speaking of the lack of concerted efforts to gather up these important evidences of early man, and the need of a museum in San Francisco to illustrate the ethnology of the coast races, the *Bulletin*, of that city, says:

The field for exploration has been considered one of the most important on the globe. It has attracted the attention of scientists in Europe, and for years agents of scientific societies have been at work here. M. Pinart, a French scientist, has been working on this coast for years. He is an original investigator. He goes everywhere. Now he is in British Columbia, and next he may be on the islands in Tulare Lake exhuming skeletons. Then he goes off to Arizona, spends weeks or months among the Indians, learning their language, notes down every word he finds, formulates dictionaries, makes accurate drawings of the prehistoric ruins of Arizona, transcribes all the hieroglyphics which he finds, gathers up implements illustrating the Stone Age, looks into all the relics of Aztec civilization, examines hundreds of skulls and skeletons, and transmits the more valuable to Paris. Next he is in Sonoma doing the same kind of work. Probably, first and last, M. Pinart has sent over to Paris nearly a shipload of specimens. If these were now arranged in San Francisco, one of the most interesting museums of prehistoric records would be found here. But the specimens are not in San Francisco. No systematic effort has been made in that direction. M. Pinart makes his shipments, and prosecutes his scientific investigations from year to year.

Professor Bird has asked an appropriation by Congress for the prosecution of substantially the same work. He notes the fact that these relics are fast disappearing. That in a short time the records illustrating the ethnology of the Pacific side will disappear. The Smithsonian Institution, he thinks, ought to prosecute investigations in this field. Pierre Loriliard also proposes to bear half the expenses of a French expedition to Mexico for the same purpose. The relics discovered are all to be deposited in a French museum in Paris. M. Charney, a French savant, is to make the explorations. Nothing is gained for this country except the honor of having a man liberal enough to make a large appropriation for the purpose of adding something to the knowledge of the world touching prehistoric races. No doubt the interest which foreign countries are taking in the investigation has stimulated the managers of the Smithsonian Institution to ask for an appropriation from Congress for a like purpose.

The collection which has been deposited in this city illustrating prehistoric times, and especially the ethnology of races, amounts to very little. There is an odd specimen here and there—a skeleton, a skull, and a few stone implements, and that is about all. California is rich in their records; Arizona is richer still; Sonora, and all Mexico, are full of them. They are of sufficient value to be shipped to Europe. These shipments include some of the rarest specimens known in the world. New Mexico is also one of the most interesting fields for archæological investigations on this continent. The French scientists understand all this. They have now two expeditions in the field, or will have in a few days. M. Pinart's investigations are recorded in quarto pamphlet publications in Paris, and these in time form large volumes covering his archæological investigations. Probably M. Charney's investigations will be recorded in the same way. This country is not treasuring up her own historical monuments. They are treasured up by foreign scientific bodies. Is there no scientific body on this northwest coast which can prosecute investigations in this department?

It would take a few thousand dollars to lay the foundation of one of the most interesting museums in the world. One or two men in the field would be sufficient. No doubt arrangements could be made for duplicate specimens to be furnished by the investigators now in the field. But what is most remarkable is that San Francisco, which is almost in the center of the most interesting fields for archæological and ethnological investigations in the world, has no public collection, no museum illustrating these departments of science, although there are hundreds of odd specimens owned by individuals here and there. It was reserved for a French savant to give the most accurate explanation of the mounds which are found in this State, some of which are hardly more than an hour's ride from the city. He opened these mounds, exhumed the skeletons, examined all the articles deposited, and gave a more intelligent and satisfactory account of the origin and purpose of the mounds than had ever been given before.

MECHANICAL INVENTIONS.

Mr. Martin A. Bidwell, of Sacramento, Ky., has patented an improvement in that class of shingle machines in which the shingles are split or rived from blocks or bolts and afterward smoothed and tapered, and has for its object to furnish machines so constructed that the shingles will be rived, smoothed, and tapered by a continuous operation.

An improved hand power attachment for sewing machines has been patented by Mr. Charles T. Christmas, of Riverton, Miss. The object of this invention is to furnish an attachment adapted for connection to the treadle of a sewing machine, whereby the machine may be driven by hand alone, or the attachment used to assist the operation of the machine by foot; and the invention consists in a certain novel combination of devices adapted for connection to the machine.

Mr. Frederic W. Lisk, of Belmont, O., has patented an improved valveless engine that when in operation shall move continuously in one direction, and shall transmit its motion by means of elliptic cog wheels.

Engineers' Club.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Arthur Sheafer read a paper on the Olean, Bradford and Warren and the Kendall and Eldred railroads, in the oil regions of McKean county, Pa. The O. B. & W. R. R. is 23 miles in length, from Bradford, Pa., to Olean, N. Y., reaching a height of 960 feet above Olean, or 2,398 feet above tide. Gauge, 3 feet; rails, 35 to 40 lb. per yard; maximum grade, 185 feet per mile, two miles being at a grade of 180 feet per mile; maximum curve, 30°, 350 feet in length on trestle 25 feet high. The road was commenced in November, 1877, and in sixty days trains were running between the termini.

The K. & E. R. R. is 18¾ miles long, from Bradford to Eldred, McKean county. Gauge, weight of rails, and maximum curves, same as O. B. & W.; maximum grade, 186 feet per mile; summit, 656 feet above Eldred, or 2,099 feet above tide. Crosses the Allegheny river on Howe truss bridge of two 90 foot spans. Its total cost, including equipment, was $150,000. In August, 1878, or ninety days after running preliminary lines, trains were running from Bradford to Eldred.

Mr. Neilson gave some notes on the Chicago and Tomah Railroad (narrow gauge), on which 20 lb. rails were used, even on 25° curves, and trains of seven cars, each of 13 gross tons weight, were run.

Mr. A. R. Roberts announced a recent trial run on the Bound Brook Railroad, by the single driver engine, of 89,¾ miles, in 97 minutes, with four cars, and returning in 96 minutes with five cars. One run of 27 miles was made in 26¼ minutes. No heating of the machinery was observed.

Mr. J. J. DeKinder illustrated the French method of submarine diving, which is a great improvement on the old method, with heavy helmets, etc. The apparatus is composed of a horizontal cylinder, surmounted by another cylinder at right angles to it, with a rubber cap. The lower cylinder is connected with the air pump by a tube, and the upper by another tube with the diver's mouth. A spring clamp is worn on the nose, the tube held in the mouth, and the apparatus worn on the back like a knapsack. By the action of valves, the air is circulated as the diver breathes, and he is encumbered with no other apparatus. His loaded shoes do not interfere with ease of motion, and he can rise at will. As little diving is done in winter, the temperature of the water is not an objection to its general use.

The Desert of Sahara.

A correspondent of the Chicago *Times*, writing from the oasis of Tafilet, in the Sahara, April 7, says that so far from being a desolate plain of moving sand, as popularly believed, the Sahara is a cultivated country, fruitful as the Garden of Eden. Like our "great American desert," it has been greatly belied. El Sahr, as the Arabs pronounce it, is indeed a vast archipelago of oases, offering an animated group of towns and villages. A large belt of fruit trees surrounds each of these villages, and the palm, the fig, the date, apricots, pomegranates, and vines abound in the utmost profusion. Ascending the Atlas Mountains by a gradual slope to the region of high table lands, we come to the land of the Mozabites, or Beni Mozab, and then comes a gradual descent for three hundred miles to the vast stretch of treeless country known as the great desert.

The rivers have an inclination of about one foot in four hundred. Many of the streams are dry, except after rains, when they deluge the country. Gun-shots are fired as soon as the torrents appear; all objects are removed, and soon, with a terrible noise, the flood rolls on. The Saharian city stands as if by magic on the banks of the waters which rise to the tufts of the palm trees; but a few days only elapse ere all disappears, leaving the district rich and fruitful. The inhabitants are not a migratory people, and, unlike the tent-dwellers of the northern slope, live in substantial houses with thatched roofs and ceilings of cane laid upon joists of olive wood. These houses generally consist of but one room, and have no furniture except mats on the floor and upon the walls for three or four feet high. Beds are sometimes found, but no one thinks of sleeping on them. The walls are white washed and inscribed with verses from the Koran. The inhabitants are made up of genuine Arabs and Berbers, or Kabyles, as the French call them. Jews are found in every oasis, and all very prosperous and influential, doing much of the trading and making up of the great caravans.

The Decay of Woodwork Out of Doors.

How to prevent the decay of woodwork exposed in open air to the changes of the weather, to alternations of wet and dry, heat and cold, is a problem that has taxed the ingenuity of man everywhere, and particularly in new countries, where wood is the only material available, or at least the only one easily employed in the erection of buildings. Most timbers, worms and insect enemies apart, will last a long time, if kept constantly dry or constantly wet in an equable atmosphere; but they will not long resist the effects of constant alternations from dry to wet and from wet to dry. More especially is this the case where the wood is placed in the ground, as in the case of the main sills of wooden houses, of post for railings, etc. Charring, painting, or tarring the surface of the wood is often adopted; but these remedies, even if always applicable, do not always produce successful results. They need to be continually renewed, and they certainly do not preserve the wood from the disease known as dry-rot.

The decay of wood embedded in the earth is also difficult to guard against; but, according to the *Farmer's Gazette* (Dublin), a simple precaution, costing neither money nor labor, will increase the durability of posts put in the ground by fifty per cent. This is simply by taking care that the wood is inverted—*i. e.*, placed in the opposite direction to that in which it grew. Experiments have proved that oak posts put in the ground in the same position as that in which they grew, top upwards, were rotten in twelve years, while their neighbors, cut from the same tree, and placed top downwards in the soil, showed no signs of decay for several years afterwards. The theory is that the capillary tubes in the tree are so adjusted as to oppose the rising of moisture when the wood is inverted.

Enjoined from Using his Own Name.

At St. Louis, recently, Judge Boyle rendered a decision in the case of Skinner *vs.* Oakes. It was a suit to restrain the defendant from using his own name in his own business. It seems that Oakes and Probasco were partners in the manufacture of an article of taffy called "Oakes' Candies," which became so popular that children cried for it and would have no other. The candy store was sold out to Skinner, with the right to make the taffy, and Oakes afterward opened a new shop, and manufactured Oakes' candies, the same as before. Skinner applied to the court to enjoin Oakes from calling his candies by that name, and also from using his own name in his business. Judge Boyle, after hearing the evidence, granted the injunction, and delivered a lengthy written opinion. After showing that the label put on his candy by Oakes is an infringement of the trade mark of Skinner, the judge goes further and says:

"I am also of the opinion that this restriction is not confined simply to the use of the words 'Oakes' candies,' as forming a single name, but to the use of the word Oakes at all in connection with the manufacture or sale of candies in this city. For to place this name in a position that it may be read at the same time or place that candies are displayed, is to impress upon the mind Oakes candies just as clearly and unmistakably as if the words 'Oakes' and 'candies' were printed or painted upon a sign as forming but one name. If one in search for what is known as Oakes' candies finds a store containing candies and upon its sign the name of Oakes, he would be simply an idiot not to connect the one with the other and believe he had found the object of his search."

Under this decision Oakes will be obliged either to change his name or quit the candy business. Like Esau, he sold his birthright for a mess of taffy, and must put somebody else's name on his packages. As the children cannot be made to believe that that which they call Oakes' candy by any other name will taste as sweet, the only thing left for Oakes is to shut up shop, or get himself newly baptized. His occupation, like Othello's, is gone, so far as his good name is concerned. If he should start a pickle factory and put his name on the jars of gherkins, the children would believe the cucumbers to be Oakes' candy colored green, and buy them as real taffy. Mr. Oscar Gray, the defendant's attorney, talks of filing a motion asking the judge to amend the decree by changing Oakes' name to Acorn, so that he can continue in the candy business without being considered a counterfeit of himself.

A New Street Sweeper.

A new street sweeping machine, devised by Mr. F. W. Schroder, of this city, promises to greatly reduce the cost of keeping streets clean. The dirt is swept by revolving brushes upon a traveling canvas, on which it is carried to a chute leading to a dump cart, into which it is discharged. When the cart is full the chute is raised by a lever, which also detaches the cart. The brushes make 240 revolutions a minute, and the canvas travels between 30 and 40 miles an hour. Two men are required for the machine, the driver and the man to attend to the chute. It is claimed that each machine will clean over a mile of street in an hour. The largest machines are 19 feet long, 6 feet wide, and 7 feet high; they weigh 5,400 pounds, and cost $650.

THE Assistant Treasurer of the United States in New York has notified Secretary Sherman that unless the silver dollars stop pouring into the vault from the Mint, that receptacle will soon overflow, and he will really be in distress to know what to do with them. He has over five hundred tons on hand just now, and nothing will persuade anybody to accept them in payment of dues when they can avoid it.

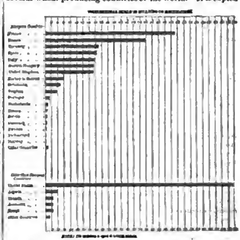
Persistent Life of Girdled Trees.

Usually a girdled tree soon dies; but it would appear from the following statements of Mr. W. H. Ragan, of Clayton, Ind., that such is not always the case:

"Hon. F. Beeler, General Superintendent of the Indiana State Board of Agriculture, living four miles southwest of Indianapolis, has a Scotch pine tree from which the bark has been removed for a space of almost a foot, when about three inches in diameter. At this point the wood is as dry and lifeless as a table leg, but above, the top is healthy, making regular and thrifty annual growths, bearing and perfecting seed, and to all visible appearance as healthy as though nothing unusual was the matter with the tree. This condition has existed for years, and the growth above the girdled point has increased to more than three times the size of the tree below. This tree was girdled by the sapsuckers. The other is a tree of the same variety on the farm of Allen Miles, two miles east of Belleville, in Hendricks County, Indiana, which was completely strangled by an iron ring, two and a half inches in diameter, being dropped over it some years ago. Below the ring for several inches the wood is dead and dry as though it had been in a dry kiln for years; above it is greatly enlarged, perhaps quadrupled in size, and still alive, though declining."

WHEAT PRODUCTION OF THE WORLD.

The Bureau of Statistics of the United States Treasury Department publishes the following diagram as showing the proportionate annual average production of wheat in the several wheat producing countries of the world. It is copied



from a semi-official French source, but with the explanation that the product of France for 1879 was 25 per cent *below* the annual average, that of Russia 10 per cent *below*, and that of the United Kingdom, or Great Britain, 50 per cent *below*, while the actual production of the United States was slightly *above* what is given as an average.

Extensive Filtering.

The Holyoke (Mass.) correspondent of the *Paper Trade Journal* says that a filtering experiment on a large scale is about to be tried by a company in that city, to obtain pure water for washing purposes in the manufacture of paper. Quite near the mills is a piece of land lying lower than the canal, and this the company proposes to fill with water to the extent of about three acres. Pipes will conduct the water from the canal bank into a bed of gravel some eight feet in thickness, through which it will pass, and it is expected that the filtering and the subsequent standing of the water in the reservoir will purify it sufficiently. The water will be about ten feet deep on an average, and will be pumped from a point about midway between the surface and the bottom. The experiment is a new one, and will be watched with interest.

Vennor's Prophecies.

Mr. Henry G. Vennor comes forward again with his direful prophecies of storms, heat, cold, etc. His letter is dated at Montreal, May 18, and in it he says: "I believe that June will be an intensely hot month, on the whole, but the end of the present month, and probably 'the first of June,' will be fall-like with frosts again. July will be a terrible month for storms, with terms of intense heat, but another fall like relapse, with frosts, will in all likelihood occur a few days before the 20th. I fear the storms of thunder and hail will be of unusual severity during July. I must claim the verification of my prediction relative to 'a cold wave with frosts, over a large portion of the United States between the 10th and 15th of May.' The relapse toward the close of the present month will be more severe than that just past."

IT is well known that butter, cream, milk, and flour are peculiarly liable to absorb effluvia, and should, therefore, never be kept in mouldy rooms, or placed where there are sour liquids, aromatic vegetables, such as onions, cabbage, and turnips, or smoked fish or bacon, or indeed any kind of food or thing of strong odor, lest they lose their flavor. But alas, add the *Sanitarian*, how much more essential is it that the utmost care be used in the prohibition of bedside food and drink in the nursery and the sick room, a practice fraught with constant danger to the sick, and of spreading disease to the well.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

The "Finger Annunciator," and all other electr. apparatus, by the Finger Annunciator Co., 73 Cornhill, Boston.

Lubricene, Gear Grease, Cylinder and Machinery Oils. R. J. Chard, 6 Burling Slip, New York.

Wanted—A Foreman of experience, capable of running a Jobbing Machine Shop employing forty men. Address, with references, W. C. & Co., P.O. Box 6, Chicago, Ill.

Improved Machinery for Waxing Paper for Sale, including an established trade. Price reasonable, profits good. For particulars, address E. W., P. O. Box 773, New York city.

[From the Jackson (Miss.) *Clarion*.]

Mr. C. H. Manship, of Jackson, one of the best painters in that State and a gentleman of great intelligence and worth, says, in reference to H. W. Johns' Asbestos Liquid Paints: "I have tested them fully and am prepared to say that the paints, which are of all colors and shades, are not only the cheapest, but the best I have used in my experience as a painter for the past fifty years."

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Carbon Plates. 88 Railroad Ave., Jersey City, N. J.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 49 & 50 Astor House, N.Y.

Purves' Automatic Boiler Cleaner for removing impurities from the water in steam boilers, and keeping them cleaned and free from scale. Send for circular to Joseph T. Janes, No. 11 Franklin St., Chicago, Ill.

R. R. Hind, inventor of the new steam boiler described on page 326, current volume, may be addressed until July 10, 1880, in care of W. R. Crossman & Co., 110 Chambers St., New York.

Manufacturers of machines to cleanly remove hulls and germs from well soaked corn without injuring the rest, please address, with description and price, D. H. Gardan, Room 23, Cooper's Union, New York city.

Asbestos Board on Chimneys prevents their heat from affecting the temperature of rooms through which they pass. Asbestos Pat. Fiber Co., lim., 194 Broadway, N. Y.

Air Compressors. Clayton Steam Pump Works, Brooklyn, N. Y.

Wilson's Business Directory, second edition, and Wilson's Co-partnership Directory for 1880-81, are now ready. Price, $3 each. All orders addressed to the Trow City Directory Company, No. 11 University Place, New York, promptly attended to.

$5 to $50. A County Right. A Clothes Line Fastener. Sample by mail, 20 cents. J. A. Worley, Cleveland, O.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, & Hand Presses for Metal Workers. Moderate prices. Peerless Punch & Shear Co., 52 Dey St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Steel Figures, $1; Letters, $3 a set. York & S., Clev., O.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 365.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Forsaith & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

For Alcott's Improved Turbine, see adv. p. 364.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 364.

Eclipse Portable Engine. See illustrated adv., p. 349.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

4 to 40 H. P. Steam Engines. See adv. p. 348.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Blake "Lion and Eagle" Imp'd Crusher. See p. 365.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 380. Totten & Co., Pittsburg.

Silent Injector, Blower, and Exhauster. See adv. p. 364.

Horizontal Steam Engines and Boilers of best construction. Atlantic Steam Engine Works, Brooklyn, N. Y.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Peck's Patent Drop Press. See adv., page 364.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 365.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

For Superior Steam Heat. Appar., see adv., page 365.

We will purchase or manufacture on royalty, Stationers' Articles of real merit. A. C. Farley & Co., Phila., Pa.

Valve Refitting Machine. See adv., page 364.

Cut Gears for Models, etc. Models, working machinery, experimental work, manufacturing, etc., to order. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of last week.

Special Wood Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 380.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Inventors' Institute, Cooper Union. A permanent exhibition of inventions. Prospectus on application. 733 Broadway, N. Y.

Improved Work Holder for Lathes, Gear Cutting, Attachments for Lathes. Tyson Vase Engine. Small Steam Motor. No boiler, no danger. Send for new catalogue, 1880. Jackson & Tyler, Baltimore.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 365.

Hydraulic Cylinders, Wheels, and Pinions, Machinery Castings; all kinds; strong and durable; and easily worked. Tensile strength not less than 65,000 lbs. to square in. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

New Economizer Portable Engine. See illus. adv. p. 365.

Catechism of the Locomotive. 625 pages. 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., and 85 Liberty St., N. Y. city, U.S.A.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

NEW BOOKS AND PUBLICATIONS

HUBBARD'S RIGHT HAND RECORD AND NEWSPAPER DIRECTORY, 1880. New Haven: H. P. Hubbard. Price $1.50.

The favorable opinion of Hubbard's Right Hand Record, expressed by us last year, is equally justified by this year's issue. It gives a complete list of all the newspapers published in America, and all the leading newspapers of the world. The names are arranged in alphabetical order under the towns of each State (also alphabetically arranged), with population of town, circulation of paper, blank spaces for advertising records, etc. Business men cannot fail to find it right handy as well as useful.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) D. J. F. writes: I would like to get a book by which I could get the correct way of getting at the lead and lap and cushion of steam engines, and what cushion and what lead are required to engines of different sizes and speeds; likewise some information of compound engines and their handling; in fact a book of plain questions and answers which any man can see into. A. Consult "Roper's Land and Marine Engines," "Edwards' Catechism of the Marine Engine," "Forney's Catechism of the Locomotive."

(2) G. R. C. writes: Referring to "Notes and Queries," No. 15 (May 1), we do not understand what is meant by T = latent and sensible heat. A. T = sum of latent and sensible heat—sensible heat of steam at the pressure of the atmosphere is 212°, and the latent heat 965°, sum = 1177°. 2. With water at 50° and steam 600 lb., what percentage of fuel is saved by using water at 100°, also at 150°? A. You can have no water at 50°. With steam pressure at 60 lb. pressure, it will be about 307°.

(3) J. N. H. asks: Does electricity pass between two points more easily in air than in a vacuum? A. More easily in air than in a high vacuum, as it is possible to create a vacuum so perfect that a spark will not pass at all. The spark passes more easily through rarefied air than through air at the ordinary density.

(4) E. L. P.—A good common black ink is prepared as follows: Dissolve 15 parts extract of logwood in 900 parts of water, allow to deposit, heat to boiling, and add 4 parts crystallized sodium carbonate. Dissolve in 100 parts of water 1 part of yellow potassium chromate, and add this drop by drop, with constant stirring, to the logwood solution. After standing for a few hours the ink will have assumed a full bluish-black color.

(5) J. M. asks: 1. Do you know of any solution with which to moisten tissue paper in order that a press copy may be taken from writing which has already been once copied, or from writing too old to copy from ordinary water moisture, and which will not discolor the paper? A. Try a weak solution of tannic acid. 2. In looking over my back numbers of SCIENTIFIC AMERICAN I found a receipt in No. 11, Vol. 26, page 171, query 8, which I tried, but without success; it also colored the paper green. Or is there any ink from which two press copies may be taken with an interval of about a week or ten days between the copies? A. A strong aqueous solution of aniline blue, violet, or black (soluble nigrosine) will answer your requirements very well.

(6) H. O. asks: What are the exact proportions of sulphur, lampblack, and niter in gunpowder? A. English war powder—niter 75 parts, sulphur 10, charcoal 15. French war powder—niter 75 parts, sulphur 12½, charcoal 12½. Sporting powder—niter 76·9 parts, sulphur 9·6, charcoal 13·5. Blasting powder—niter 62, sulphur 20, charcoal 18.

(7) T. R. M. writes: I have a large wooden cask for holding maple sap. What could I paint it with on the inside, to prevent the sap from penetrating the wood and souring, that would not injure the sap? A. Have you tried melted resin colophony?

(8) E. K. writes: I have a good deal of copper plating to do. The solution I have, I succeeded so far of obtaining a nice bright copper color, but it will not keep. After I washed it off with warm water and exposed to the air for half an hour it turned into a rusty brown. My solution consists of *Schwefelsaures Kupfer* dissolved in water with some sulphuric acid. How can I make the right kind of solution for such purpose? A. Use a saturated aqueous solution of copper sulphate (blue vitriol). Clean the work thoroughly by boiling in strong soda solution, pickling in dilute sulphuric acid, and scouring with clean sand, if necessary. If the work is iron use a strong battery at first.

(9) R. A. P. asks (1) for a certain and yet safe exterminator for roaches or croton bugs. A. Powdered borax does very well if properly used. Inject it, by means of a small bellows, into all the crevices and holes.

(10) F. C. R. asks: 1. Why are rotary engines not used for all the purposes of an engine? A. Because it is almost impossible to keep them tight under the conditions of constant use, and it is difficult to arrange them to work expansively to the desired extent. 2. Is there any method of reversing a rotary engine? If so, where can I find information regarding it? A. There is no difficulty in reversing them. You can find description in almost any history of the steam engine and in the back numbers of the SCIENTIFIC AMERICAN.

(11) F. G. N. writes: 1. I am building a light paddling canoe, according to the descriptions contained in the SCIENTIFIC AMERICAN SUPPLEMENT, Vol. ix., No. 219, page 3484, and do not understand how to make the watertight bulkheads. A friend told me that the sides to which the slats are made are curved by steam. Explain the building of the watertight bulkheads in your valuable paper, and if curved by steam, please tell me how it is done. A. Make the bulkheads of rubber cloth or cotton canvas painted, closely nailed around the edges. The sides are steamed in an ordinary steam box and bent to shape and fastened on a proper form and left to dry on the form.

(12) L. V. A. asks for a remedy for removing freckles and tan from the face. A. The following has been recommended: Sulpho-carbolate of zinc 2 parts, pure glycerine 25 parts, rose water 25 parts, alcohol 5 parts. Apply twice daily for a half hour.

(13) N. L. writes: I am building a small horizontal double cylinder steam engine, two and a half inch bore and four inch stroke, what is its power? A. At 200 revolutions per minute, 2½ horse power. 2. How large a fly wheel will it require? A. About 16 or 18 inches diameter. 3. What is the number of thread to the inch in machine taps standard from ¼ inch to 6 inches? A.

Diameter in inches	¼	5/16	⅜	7/16	½	9/16	⅝	¾	⅞	1
Threads per inch	20	18	16	14	13	12	11	10	9	8
Diameter in inches	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	2½
Threads per inch	7	7	6	6	5½	5	5	4½	4½	4
Diameter in inches	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5
Threads per inch	4	3½	3½	3¼	3	3	2⅞	2¾	2⅝	2½
Diameter in inches	5¼	5½	5¾	6						
Threads per inch	2½	2⅜	2⅜	2¼						

4. Do you think the iron mercury flasks would be strong enough to run the above engine? Where can I buy them? A. Yes, you can generally obtain them from druggists.

(14) W. L. H. asks: How much lead of the valve should the valve of a 100 horse power engine have, and what is the rule for giving a valve the required amount of lead? A. Probably about three-sixteenths inch. There is no rule; it depends upon pressure of steam, size and form of opening, and the velocity of the engine.

(15) A. M. asks: Is steam applied successfully to plowing? A. It has been in England, but we believe not in this country.

(16) E. W. S. asks for directions for making paste such as is used for making paper matrices for newspaper stereotyping. Would like to have directions for making the back and face paste. A. Starch and fine glue, equal parts; soften the glue by digestion over night in cold water; then dissolve it in enough hot water to make a thin size; boil the starch in water to form a clear paste; add this to the glue and stir together; thin with hot water when necessary; warm before using.

(17) W. S. H. asks: 1. How long should work be left in the nickel bath for a good deposit, if everything be in good working order? The bath is composed of sulphate of nickel and ammonia. A. About twenty minutes is usually allowed, but with a weaker battery several hours may be allowed and better work will result. 2. What should cause the work to turn out black and rough? A. The battery used is much too strong; use a more moderate current. 3. Is there any work printed on nickel plating? I have the SCIENTIFIC AMERICAN from Vol. 30, and all the SUPPLEMENTS, but do not find much in them about it. A. You will find a good article on this subject on p. 209, Vol. 38, SCIENTIFIC AMERICAN.

(18) C. H. J. asks how much a rod of common round iron, one inch in diameter, fifteen to eighteen feet long, will support on a steady strain. A. If of good iron, 3,900 lb. safely.

(19) G. W. F. asks: For what purpose is ground or powdered mica used? A. It has been used in loading some kinds of paper, in the preparation of paints and bronze powders, in connection with nitroglycerine for certain explosives, as well as in soaps. It makes an excellent fertilizer in soils deficient in alkalies.

(20) M. M. L. writes: I have a small steam yacht, 25 feet over all, 6 feet beam, propelled by a 4 flake 28 inch diameter screw; the engine is an ordinary upright link motion. Everything works very nicely except the valve to the engine, which wants facing. How shall I face it in good shape? A. If you have not access to a good planing machine, you must face it by hand, with file and scraping tool.

(21) H. S. H. asks which has the most power, 2 cylinders 8x10, connected to one shaft with an 8 foot driver or fly wheel, or one cylinder 10x18, with an 6 foot fly wheel—both to run 125 revolutions per minute. A. 10x18 inch, making the same number of revolutions per minute.

(22) E. D. F. writes: I have very nearly completed a small upright steam engine, diameter of cylinder 3¼ inches, stroke 6 inches, which I intend to run at 200 revolutions per minute. I have put on a balance wheel, 24 inches diameter, and will belt from a 12 inch pulley. How much power ought I to obtain from such an engine with 50 lb. of steam? A. Two horse power nearly.

(23) G. H. P. asks: What size boiler will it require for 1½ inch cylinder, and what should be the length of stroke? A. The stroke may be three inches to four inches; the boiler should have eight to ten feet heating surface.

(24) W. O. T. asks (1) the proper width and thickness for the packing ring of an engine, 1½ inch bore and 3 inch stroke. A. 3-16 to ⅛ inch thick and ⅜ inch wide. 2. Would the ring be better made of brass than cast iron? A. No. 3. Why are two rings used on large engines? A. To have one set break joints with the other, so as to prevent leakage and to give greater elasticity.

(25) S. B. M. asks: 1. Is the forked top on a lightning rod any better than a straight one, both being made of the same metal (copper)? A. A forked top is generally considered best. 2. I have a 30 inch wood saw, with a 150 lb. balance wheel on end of saw mandrel; saw makes about 300 revolutions to one of the horse power. I cannot get power enough in sawing large wood. Some claim it would run better without balance wheel; but I think the driving pulley is not large enough. What is the trouble? A. Keep on your balance wheel, and use two horses if one has not sufficient power. 3. Would a boiler, 10 inches diameter, 20 inches long, be sufficient to run a 1x2 engine about 45 revolutions per minute—boiler to set in a stove same as a teakettle? A. Yes. 4. Would copper, such as stove boilers are made of, be heavy enough for the boiler, and what pressure would it stand? A. Use copper three times as thick as that used in stove boilers.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. L. L.—1. Labradorite and hornblende. 2. Same as No. 1, but with more of the hornblende and also orthoclase. 4. Garnetiferous sandstone with hornblende. 3. Hornblende rock.—T. W. G.—Pyrrhotite containing a small quantity of arsenic and antimony. It cannot be called an ore. It is of very little economic value.—D. C. K.—It is a fine siliceous stone, probably of infusorial origin. It might be useful for polishing purposes if obtainable in powder or blocks free from coarse impurities.—A.—It is not a meteorite, but a fragment of altered hornblendic rock, not valuable.—W. R. L.—It is galena—sulphide of lead, carrying a trace of silver.—G. I. L.—Metallic antimony.—E. G. T.—Mica schist of little value.—O. A. E.—Manganiferous clay iron stone.

COMMUNICATIONS RECEIVED.

On Gum Elastic. By A. T.
Chemical Apparatus. By J. E.
On Edison's Light. By D. F.
On Quartz Crystals. By W. E. H.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

May 11, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Anthracene manufacture of, F. Salathe. 227,388
Axle box car, D. J. Timlin 227,437
Bail and rim bending machine, J. Geiger 227,425
Basin or sink for kitchens, etc., wash, F. Rauscher 227,365
Beer cooler, W. Schwartz 227,433
Bell, electric alarm, C. Heisler 227,488
Belt tightener and regulator, F. Paquet........ 227,392
Blackboard, J. A. Crandall 227,402
Blind and shutter, comb'd window, H. F. Watson 227,397
Blind slat operator, N. M. Hotton 227,532
Boiler and furnace, G. Bell 227,475
Boiler scale collector, Youngblood & Holmes 227,605
Boot and shoe stiffener, metallic, J. Barsaloux (r). 9,198
Bottle stopping device, B. Hollender 227,539
Bracelet, C. H. Bishop........ 227,436
Breakwater, H. Case........ 227,488
Breastpin, G. D. Stevens........ 227,500
Bucket, slop, H. O. Reese........ 227,577
Buckle loop, G. R. Kelsey........ 227,541
Butter, device for preserving, L. T. Hawley 227,442
Button, flexible center, N. H. Bruce 227,479
Button, separable, C. B. Carpenter........ 227,465
Can capping machine, Adams & Rennoburg........ 227,469
Canal lock, T. Milette 227,563
Canceling device, pyro, A. B. Gear........227,423, 227,424
Car brake, H. M. Lee........ 227,308
Car coupling, L. J. Johnson........ 227,528
Car, dumping, J. J. Hill........ 227,434
Car heater, street, G. C. Bovey........ 227,345
Car propeller, street, H. E. Depp........ 227,472
Car replacer, W. Y. Flynn........ 227,427
Car wheel, J. Alsterdam 227,407
Card holder, J. F. Emerson 227,560
Carpet stretcher, G. D. Harteack 227,324
Cartridge capping and uncapping implement, C. W. Corf 227,340
Clasp, J. H. Eastman (r). 9,194
Cloth, etc., machine for cutting, J. Crotte........ 227,494
Clothes drier, G. W. Rogers 227,365
Clutch, Harlow & Barker........ 227,538
Coal cutting and mining machine, J. Gowland.... 227,354
Cockle separator, F. A. Balch........ 227,471
Collar and hame fastener, M. T. Hayes........ 227,431
Colter, K. W. Manwaring 227,322
Condenser for steam escapes, Alberger & Sault... 227,343
Corn and phosphates, machine for dropping, M. Humphrey 227,300
Corn sheller and cleaner, N. Stedman........ 227,432
Cornice, curtain, H. H. Winger........ 227,605
Corset clasp, Frane & Janssen........ 227,513
Cotton, preparing absorbent, L. A. Buckman 227,490
Cotton presses, band tightener for, J. L. Sheppard 227,340
Cultivator, O. J. King 227,543
Cultivator, S. T. Jamw 227,370
Cultivator, J. H. Peirce........ 227,383
Currying knife, J. Tuggle 227,565
Cutter head, H. L. Bertermann........ 227,407
Dairy bureau, C. A. & G. A. Mosher........ 227,367
Derrick for hoisting, grubbing, etc., J. Mothersil. 227,442
Disintegrating ramie, etc., machine for, A. Angell 227,409
Dissolving apparatus, J. Tregartha........ 227,396
Dividers, C. F. A. Reimann........ 227,573
Door check, C. T. Close 227,414
Draught for plows, central, L. Begon........ 227,436
Drain, gas, and water pipe, M. M. Camp........ 227,611
Earring, L. Rieger, Jr........ 227,301
Egg beater, Morse & Burnham........ 227,378
Egg carrier, D. Goodwillie 227,516
Electric light switch, E. B. Knowles........ 227,365
Elevator, J. Q. Myers 227,370
Elevator fan attachment, L. Davis 227,607
Elevator for loading and unloading cattle on shipboard, H. P. Kirkham 227,544
Emery wheels, treatment of, J. F. Wood........ 227,402
Explosive compound, R. W. Warren........ 227,403
Faucet, water, J. Tucker 227,395
Felly boring machine, J. G. Pease 227,573
Fence wire stretcher, W. A. Murray 227,442
Firearm, revolving, J. H. Bullard 227,401
Firearm, revolving, G. W. Schofield........ 227,449
Fire escape, C. C. J. Wood 227,401
Fire place fender, J. H. Kisor 227,546
Fire screen, W. P. Owen 227,308
Flue cleaner, W. G. Williams 227,309
Foil, making metallic, H. S. & L. Crooke. 227,485, 227,486
Fruit drier, J. H. Burke 227,482
Furnace, J. H. Irwin 227,365
Furnace, etc., lining, J. P. Kimball 227,342
Galvanic battery, R. Schlumberger 227,463
Garden rake, cast steel, C. T. Beebe 227,473
Gas apparatus for enriching, Livesey & Kidd........ 227,347, 227,348
Gas, apparatus for enriching, Livesey & Kidd 227,349
Gas apparatus for making illuminating, W. H. Douglass 227,350
Gas burner and regulator, self-extinguishing, W. H. Hovey 227,436
Glass pitcher, J. Grandy 227,430
Glass, porcelain, etc., joining pieces of, A. Man 227,330
Glove or garment fastener, spring, A. G. Mead .. 227,440
Goods, implement for handling shelf, A. F. Parry 227,444
Governor, steam, G. E. Noyes (r) 9,196
Grain, etc., apparatus for drying and renovating, J. McCoy........ 227,326
Grinding mill, O. R. Winger 227,465
Hame fastener, A. C. Richardson........ 227,394
Hammer, steam, J. Walt........ 227,437
Harness check hook, G. W. Hinkle 227,435
Harrow, D. B. Eberly........ 227,392
Harrow, A. Low 227,551
Harrow, J. A. Prindle 227,445
Harrow teeth, spring, A. P. Sprague 227,368
Hat and other head covering, Helmann & Wall... 227,327
Hats, forming nape for, J. B. Russell 227,364
Hatchway door mechanism, W. L. Ely........ 227,421
Hay rake, horse, J. H. Witter........ 227,604
Indigo, manufacture of artificial, A. Baeyer........ 227,470
Induction coil, F. A. Klemm 227,546
Insulating and protecting telegraphic conductors, M. M. & R. F. Manly........ 227,371
Insulating telegraph wires, coating metals, covering roofs, and for other purposes, composition for, K. Everhart........ 227,502
Ironing board, G. W. King 227,300
Jetties, construction of, S. E. Hughes........ 227,531
Jewelry, imitation of mosaic for, F. H. Moyer ... 227,377
Ladder and ironing board, combined step, M. Campbell........ 227,340
Lamp and lantern burner, G. A. Beidler 227,474
Lamp, electric, W. Sawyer........227,386 to 227,390
Lamp, electric, F. Tommasi 227,396
Lamp regulator, electric, J. B. Brausedorf 227,478
Lamps with gas, apparatus for charging electric, T. B. Stillman........ 227,454
Last block fastener, U. H. Harvey........ 227,439
Latch lever, G. H. Sargent........ 227,387
Leather folding machine, C. E. Marshall........ 227,366
Leather skiving machinery, M. M. Clough........ 227,347
Letter box, W. Evans, Jr 227,509
Letter box, T. B. Lowerre 227,502
Lozenge machine, J. H. Eaton........ 227,305
Lubricator, W. & R. Paulson........ 227,570
Mailing box, C. H. Sable 227,447
Metal tubes, machine for forming seamless, A. T. Whitehouse........ 227,462
Milk cans, water tank for, Dorsey & Reed 227,500
Muff ear, I. B. Kleinert 227,364
Musical instruments, key board attachment for, J. F. White........ 227,461
Nap forming apparatus, J. B. Russell........ 227,385
Net, fly, D. Fleshbock........ 227,358
Nut tapping machine, E. P. McLane 227,330
Oil burner, petroleum, D. E. Banks 227,473
Ore washing machine, F. J. Seymour........ 227,380
Organ, reed, O. W. Bartlett 227,340
Oven, regenerative hot blast, J. M. Hartman 227,430
Ox bow fastener, H. Wojan........ 227,399
Packing for artesian wells, S. R. Dresser........ 227,419
Packing for fountains, piston or plunger, J. Hegarty 227,306
Pail, dinner, T. A. Lott........ 227,365
Paper and method of preparing the same, safety, Fortier & Wyman........ 227,300
Paper bags, manufacture of, M. L. Deering 227,350
Paper cutting machine, W. Heckert........ 227,356
Paper for beaming woven fabrics, preparing, J. Oralli et al........ 227,381
Paper, manufacture of wood pulp for, Wilson & O'Reilly 227,464
Paper pulp, moulded articles from, J. R. Hertford 227,327
Paper stock from colored rags, preparation of, Wilson & O'Reilly 227,465
Pen, stylographic fountain, A. T. Cross........ 227,416
Percussion strip, H. F. McGill 227,360
Piles, apparatus for sinking and removing, H. Case 227,484
Pitcher, porcelain lined, Miller & Berry 227,366
Pitman connection, P. W. Stanhope, Jr........ 227,338
Plane, bench, W. Steers........ 227,452
Planer tool, iron, H. Dewey........ 227,330
Planter, corn, J. W. Clark 227,409
Plow, L. Begon........ 227,416
Portable engine, E. W. Mills........ 227,366
Printing machine sheet delivery apparatus, S. D. Tucker 227,390
Printing machines, device for straightening paper as delivered from, A. Binkard 227,341
Printing press, oscillating, H. S. Griffiths........ 227,330
Propeller for boats, sculling, T. J. Coulter........ 227,401
Pulley, expansion, Hill & Hulbert........ 227,399
Pump, D. P. Manrose 227,439
Pumping apparatus, W. V. Henry 227,338
Radiator, steam, E. F. Gordon 227,317
Rail chair, J. B. Tarr 227,456
Railway cross tie and rail fastening, D. S. Wittenhall 227,432
Railway joint, H. E. Greenwell........ 227,319
Railway joint, J. W. Hudson........ 227,330
Rakes, manufacture of solid shank cast steel, J. B. Hamblin........ 227,321
Refrigerating apparatus, J. C. Mack 227,556
River channels, machine for deepening, T. B. Taylor 227,390
Sand paper holder, C. M. Lothrop........ 227,436
Sash lock, G. J. Metzger........ 227,562
Saw, circular, J. E. Lockwood (r)........ 1,197
Scale beams, poise for, W. W. Reynolds 227,379
Scissors, J. D. Frary 227,512
Scraper, sweat, R. S. Judson........ 227,365
Screw stock, P. Everitt........ 227,308
Seal press, J. M. Harding........ 227,322
Seggars and other pottery ware, manufacture of, O. O. Bowman........ 227,409
Sewer gas trap, J. A. Burgess 227,411
Sewing machine driving mechanism, C. L. French 227,318
Sewing machine, hemstitch, Brown & Mayer........ 227,375
Sewing machine, running stitch, J. Heberling.... 227,325
Shatter worker, N. M. Hutton........ 227,330
Sickle grinder, F. W. Krause........ 227,308
Sieve, separating, J. H. Chase 227,466
Sifter for ashes, etc., J. H. Chase 227,467
Slate, book, Pruyn & Hyatt........ 227,374
Sleigh knee, J. C. Storm 227,406
Smelting furnace, W. Fields........ 227,310
Smoke and cinder conveyer for locomotives, J. S. Lloyd 227,360
Soda, making bicarbonate of, W. J. Menzies........ 227,361
Spark arrester, J. D. Brown 227,412
Spark arrester, Dunn & Havener 227,420
Spinning machinery, automatic roving piecer and breaker for, H. C. Grayson 227,427
Stairway elevator, J. I. Tay........ 227,459
Stamp, hand, C. C. Wilson........ 227,462
Starch press, R. Johnson 227,307
Starching machine, W. H. Robertson........ 227,398
Steam boiler, J. R. Jerrold 227,330
Steam generator, T. J. Leiper........ 227,432
Steam heaters, air valve for, Jones & Holt........ 227,301
Steam railway brake, J. Woods 227,410
Steaming apparatus, B. H. Scott 227,451
Stove casing, W. B. McBee 227,546
Street sprinkler, W. B. Paddock........ 227,340
Striping machine, J. Dion........ 227,301
Sugar, apparatus for cooling cube, J. Y. Y. Doornam 227,477
Suspender ends, buckle loop for, R. A. Smith 227,391
Switch stand, A. E. Mansfield 227,373
Tally, grain, R. G. Brown 227,409
Tally, lumber, J. L. Paxson 227,371
Tap, expansion, L. H. Stockwell........ 227,394
Thill coupling, A. B. Kurtz........ 227,307
Ticket reel, J. S. Ives 227,324
Tire upsetter, J. F. McCoy........ 227,337
Toggle bearing, compensating, S. L. Marsden 227,364
Tool handle, A. Nawadny 227,380
Toy watch and clock, I. Fried 227,314
Traction engine, C. M. Miller........ 227,441
Trays, machine for making wooden, R. Richards 227,382
Tricycle, F. Fowler........ 227,513
Triturating and mixing apparatus, J. Tregurtha... 227,396
Triturating machine, I. Davis........ 227,420
Truck, hand, E. Colvin 227,409
Tug, hame, S. R. Copeland 227,480
Valve lifter, automatic, H. Tuttle........ 227,400
Vehicle brake, J. H. Coffman 227,340
Vehicle, side bar, De Grush & Wreath........ 227,420
Vehicle spring, P. C. Freese 227,312
Vehicle wheel, J. C. Turnbull........ 227,458
Ventilator, W. S. Sayre........ 227,396
Vial, H. E. Dennett........ 227,351
Vinegar, apparatus for making, V. Michaelis.... 227,304
Vise, W. Riley........ 227,392
Wardrobe and trunk, combined, W. H. Haman... 227,428
Watch barrel, J. Martin 227,374
Watch case spring, W. Dryndale........ 227,304
Watch dial, adjustable, Covell & Chase 227,423
Water closet signal, D. S. Baker........ 227,408
Water meter and motor, C. A. Reed........ 227,376
Waterproof fabric, P. Peterson 227,323
Weather strip, G. W. Bell 227,404
Whip handle, J. O. Schmidt........227,391, 227,392
Whistle for steam boilers, duplex, J. V. Jove........ 227,300
Windmill, M. Crossman 227,408
Windmill, L. M. Devore 227,418
Windmill, A. Jneife........ 227,340
Windmill, N. Small 227,401
Window and door protector, F. Guild........ 227,326
Window screen, J. Reigart........ 227,446
Yoke, neck, A. B. & J. J. Clark........ 227,415

DESIGNS.

Carpet, W. J. Gadsby 11,775
Oil cloth, C. T. & V. E. Meyer ....11,769 to 11,774
Pin, ornamental, C. Z. De Young........ 11,766
Ring, C. Z. De Young 11,767
Types, font of printing, C. K. Heyer........ 11,768

TRADE MARKS.

Beer, lager, P. M. Ohmeis & Co........ 7,905
Bitters, liniment, and kindred medical preparations, Gentian Bitters Company 7,901
Charts for draughting garments, pattern, E. J. Lock 7,902
Cigars, cigarettes, and smoking tobacco, Stratton & Storm........ 1,904
Game or toy, boxes containing the apparatus for a, M. J. Rice........ 7,903
Tobacco, smoking, Weisert Brothers 7,906

English Patents Issued to Americans.

From May 11 to May 14, 1880, inclusive.

Audiphone, O. D. Orvis, Chicago, Ill.
Game apparatus, M. T. Foote, U. S. A.
Harrow and roller, R. H. King, Independence, Kansas.
Heddles for looms, S. Sewall, Jr., Tewksbury, Mass.
Ladder, extension, J. K. Richard, New York city.
Telephone exchange, G. L. Anders et al., Boston, Mass.
Umbrellas and parasols, W. A. Drown, Philadelphia, Pa.
Velocipede, F. Fowler, New Haven, Conn.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

Established 1844.

JOSEPH C. TODD,
Successor to TODD & RAFFERTY,
PATERSON, N. J.,
Engineer and Machinist.

Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery. Steam Engines, Boilers, etc. Sole Agent for Keyber's New Patent Acme Steam Engine and Force Pumps combined. Also owner and exclusive manufacturer of

THE NEW
Baxter Patent Portable Steam Engine.

These engines are admirably adapted to all kinds of light power for driving printing presses, pumping water, sawing wood, grinding coffee, ginning cotton, and all kinds of agricultural and mechanical purposes, and are furnished at the following low prices:

1 Horse Power, $140 | 1½ Horse Power, $190
2 Horse Power, 245 | 2½ Horse Power, 275
3 Horse Power, 290 | 4 Horse Power, 350

Send for descriptive circular. Address

J. C. TODD,
PATERSON, N. J.
Or No. 10 Barclay St., New York.

H.W.JOHNS' ASBESTOS
LIQUID PAINTS, ROOFING, BOILER COVERINGS, Steam Packing, Sheathings, Fireproof Coatings, Cements.
SEND FOR SAMPLES, ILLUSTRATED PAMPHLET, AND PRICE LIST.
H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

Pictet Artificial Ice Co., Limited,
P. O. Box 3083. 142 Greenwich St., New York.
Guaranteed to be the most efficient and economical of all existing Ice and Cold Air Machines.

PREVENT SLIPPING. The handsomest, as well as the *safest* Carriage Step made. Forged from best iron, and formed with a sunken panel, in which is secured a plating of richly moulded rubber. Durability warranted. Send for illustrated circular. Rubber Step M'f'g Co., Boston, Mass.

New Undestructible Water Pipe.
We are now prepared to furnish Water Pipes from 4 in. upward. Cost less than cast-iron pipe. Will not rust or corrode. Guaranteed 300 pounds pressure to the square inch. Apply WROUGHT IRON ASPHALTED PIPE CO. FACTORY, 300 East 112th St., New York City.

Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SONS, Buffalo, N. Y.

"BUCKEYE" LAWN MOWER.
The lightest and easiest running Mower ever made.
STRICTLY FIRST CLASS.
MAST, FOOS & CO., Springfield, Ohio.
Send for catalogue.

Delamater Steam Pumps,
For every variety of work.
WATERWORKS PUMPING ENGINES.
DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
Office, No. 10 CORTLANDT ST.,
Works, Foot of W. 13th St., North River, New York.
ESTABLISHED 1841.

RAILROAD DEPOTS IRON BUILDINGS WHARF SHEDS SUGAR HOUSES ... PUBLIC MARKETS ... RETORT HOUSES
WALTER C. BENSON ... GLASGOW, SCOTLAND

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

Working Models
And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.

HODGKINS & HAIGH.
Importers, Manufacturers, and Dealers in
FIRE ARMS AND SPORTING GOODS,
300 BROADWAY, NEW YORK.
Every article of substantial merit known to the Trade supplied, and orders solicited.

THE MACKINNON PEN OR FLUID PENCIL.

Particulars mailed Free.
MACKINNON PEN CO.,
200 Broadway, near Fulton St., N.Y.

The New York Ice Machine Company,
21 COURTLANDT STREET.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more Ice. Uses only ¼ water of condensation. No Pressure at rest. Pressure in running 14 pounds. Self lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

THE HOLLY ... SYSTEM OF STEAM HEATING ... LOCKPORT N.Y.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.

BOILER COVERINGS.
Plastic Cement and Hair Felt, with or without the Patent "AIR SPACE" Method.
ASBESTOS MATERIALS,
Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John Street, and Foot of E. 9th Street, New York.

COLUMBIA BICYCLE.
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of The Bicycling World.
THE POPE M'F'G CO.,
89 Summer Street, Boston, Mass.

GENUINE BABBITT METAL,
Fine Brass and Composition Castings.
E. STEBBINS M'F'G CO., SPRINGFIELD, MASS.

PAINTERS, Address for catalogue new mode of graining. J. J. Callow, Cleveland, O.

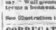
ROOFING.
For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.

A PLANING MILL OUTFIT FOR SALE
very low for cash. Will sell all together or each machine separate. All first-class machines, good order.
J. H. KERRICK & CO., Indianapolis, Ind.

Wood-Working Machinery,
such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON, 26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

Wanted in every Family.
Splendid combination. Step ladder, height, 5 feet; clothes bars, 30 feet; best ironing or skirt board, all neatly combined in one compact, durable article. Can be carried in one hand. Weighs only 18 lb. Customers say, "Well pleased." Send for sample. Price $3. Agents' terms a bonanza. Rights for sale. Address
J. R. MARTIN, Hartford, N. Y.
See illustration in SCIENTIFIC AMERICAN, March 20, 1880.

CORRUGATED AND CRIMPED IRON ROOFING AND SIDING,



Iron Buildings, Roofs, Shutters, Doors, Cornices, Skylights, Bridges, etc. MOSELEY IRON BRIDGE AND ROOF CO., 5 Dey Street, New York.

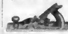
Perfectly Smooth, Thoroughly Seasoned
CUT THIN LUMBER!!
Manufactured by our Patent Board Cutting Machines and Seasoning Presses.
Pronounced the only Perfect Cut Lumber!!
MAHOGANY,
Rosewood, Satinwood, Walnut, Ash, Red Cedar, Cherry, Oak, Poplar, Maple, Holly, French Walnut, etc., etc., in Logs, Planks, Boards, and Veneers.
Send for catalogue and price lists.
GEO. W. READ & CO.,
186 to 200 Lewis St., foot 5th and 6th Sts., New York.

WOOD SOLE SHOES.
The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send stamp for circular and price list.
CHAS. W. COPELAND, 122 Summer St., Boston, Mass.

BUY NO BOOTS OR SHOES
Unless the soles are protected by Goodrich's Hemmer Heel Rivets. Guaranteed to outwear any other sole. All dealers sell them. Taps by mail for 25 cents in stamps. Send paper pattern of size wanted. H. C. GOODRICH, 23 Church St., Worcester, Mass.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

The Rodier Patent Single Iron Plane.



Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

The Asbestos Packing Co.,
Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:
PATENTED ASBESTOS ROPE PACKING,
" " LOOSE "
" " JOURNAL "
" " WICK "
" " MILL BOARD,
" " SHEATHING PAPER,
" " FLOORING FELT,
" " CLOTH.

WATCHMAN'S IMPROVED Time Detector, with Safety Lock Attachment. Patented 1875-6-7. Beware of infringements. This instrument is supplied with 12 keys for 12 different stations. Invaluable for all concerns employing night watchmen. Send for circulars to E. IMHAUSER, P. O. Box 2875. 212 Broadway, New York.

PORTLAND CEMENT,
From the best London Manufacturers
K. B. & S. AND BURHAM CEMENTS.
For sale by JAMES BRAND, 85 Beekman St., New York.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

"RELIABLE"
Engines a complete success. Prices still 40 per cent. below those of other makers. Unequaled for efficiency, simplicity, and durability. Prices from $150 for 10 H. P., to $400 for 50 H. P. All complete, with Governor, Pump, and Heater.
Address, for circular, HEALD, SISCO & CO., Baldwinsville, N. Y.

THE DRIVEN WELL.
Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
233 BROADWAY, NEW YORK.

BUFFALO BLACKSMITHS' BLOWERS & PORTABLE FORGES
FOR SALE BY ALL DEALERS
BUFFALO FORGE CO MFRS
BUFFALO, N.Y.
SEND FOR CIRCULAR & PRICE LIST

JOHN R. WHITLEY & CO.
European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E.C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

Lathes, Planers, Shapers
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.


Furnace Hoist.

ELEVATORS.
All kinds of Hoisting Machinery a specialty. Steam, Hydraulic, and Belt Power for Passengers and Freight. Iron Furnace Lifts, Portable Hoists. STOKES & PARRISH, 30th and Chestnut Sts., Phila., Pa.

To Electro-Platers.
BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with Books of Instruction for Gold, Silver, or Nickel Plating. THOMAS HALL, Manufacturing Electrician, 19 Bromfield Street, Boston, Mass. Illustrated Catalogue sent free.

52 Gold, Crystal, Lace, Perfumed, and Chromo Cards, name in Gold & Jet 10c. Clinton Bros. Clintonville, Ct.

WIRE ROPE
Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.
Wheels and Rope for conveying power long distances. Send for circular.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

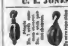
ROCK DRILLING MACHINES AND AIR COMPRESSORS
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG MASS.

FRIEDMANN'S PATENT
EJECTORS
Are the cheapest and most effective machines in the market for
Elevating Water and Conveying Liquids
from Mines, Quarries, Ponds, Rivers, Wells, Wheel Pits; for use in R. R. Water Stations, Factories, etc. They are splendidly adapted for conveying liquids in Breweries, Distilleries, Sugar Refineries, Paper Mills, Tanneries, Chemical Works, etc. Send for illus. catalogue to
NATHAN & DREYFUS,
Sole Manufacturers. NEW YORK.

ESTABLISHED ... NON CHANGEABLE GAP LATHE ... JAMES WATSON ... FRONT ST. PHILA.

OPEN BACK PRESSES.
STILES & PARKER PRESS CO., Middletown, Ct.

TELEGRAPH and Electrical Supplies. Send for Catalogue. C. E. JONES & BRO., CINCINNATI, O.

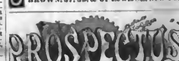


Pulley Blocks. Iron Sheaves, Phosphor Bronze Self-Lubricating Bushings. PENFIELD BLOCK WORKS, Lock Box 10, Lockport, N. Y.

AIR COMPRESSORS.
THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.

$777 A YEAR and expenses to agents. Outfit Free. Address P. O. VICKERY, Augusta, Maine.

BROWN'S PAT. SPLIT PULLEYS
Shafts, Hangers
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.



OF THE
Scientific American
FOR 1880.
The Most Popular Scientific Paper in the World.
VOLUME XLII. NEW SERIES.
Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St. New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 25. [NEW SERIES.] NEW YORK, JUNE 19, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

AMERICAN INDUSTRIES.—No. 46.

THE MANUFACTURE OF UNIVERSAL CHUCKS.

Probably no single tool used in the machine shop has effected so great a saving of labor as the Universal Chuck, and there is none requiring more painstaking and careful labor in its manufacture. It is a tool that must be well adapted to hard usage, and at the same time its construction must be such as to neither wear out of true nor get out of order. In the well known manufactory of the E. Horton & Son Company, of Windsor Locks, Conn., universal chucks are made which fulfill all these requirements, and which are ranked as the standard. It would be superfluous to say a great deal in favor of these chucks, as they are well and favorably known throughout the world.

When Eli Horton invented the chuck known as the Horton lathe chuck, there were but a few iron chucks in use of any kind, and they were very imperfect and unreliable, giving great dissatisfaction, so much so that in many instances large establishments would use only the old method of fastening wood plank to the face plate of the lathe, which was very expensive. Mr. Horton, then a machinist of over thirty years' experience, in want of a good lathe chuck, invented the chuck which has since borne his name.

There are many thousands of these chucks in use in the best shops in the country, and a single instance is not known where a party has purchased these chucks and afterward changed to any other kind.

By means of the gearing in the Horton lathe chucks, the jaws can be adjusted to a true circle within one hundredth part of an inch, to counterbalance any wear of parts. We know of no other chuck that can be so closely adjusted as this.

The castings are made of a fine quality of iron, and the jaws are made of the very best wrought iron; the racks are made of wrought iron; the pinions and screws, of the best cast steel, with wrenches of wrought iron, case hardened.

It was proved by testimony taken at the Patent Office that the Horton lathe chucks make a saving in time (taking the time of cleaning and adjusting other kinds of chucks into account) of over one hour each day while in use. This was the lowest time given, while some witnesses testified that from one to two hours each day were saved.

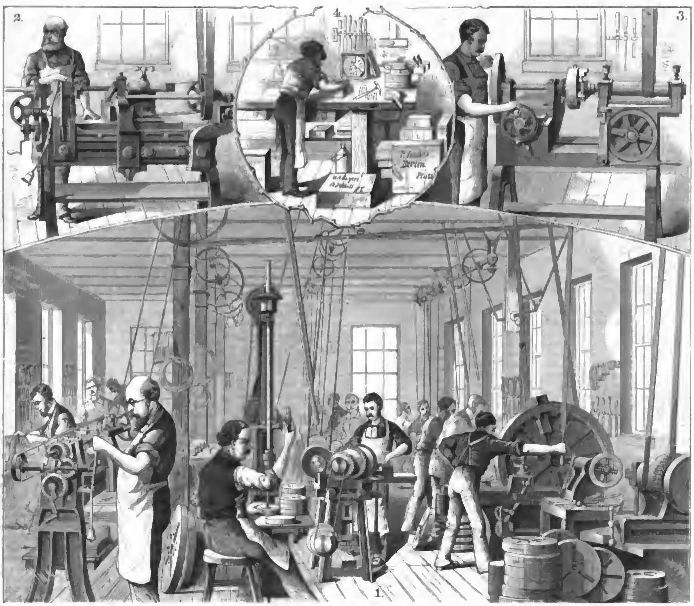
These chucks cost, in the first place, no more than other kinds of chucks, and they can be used either as independent or universal chucks, really making two chucks combined in one. This taken in connection with its other good features makes it the cheapest tool of the kind in use.

Both three and four jawed chucks are made, as well as reverse jaw chucks and milling machine chucks. The three jawed chucks vary in size from six to thirty-six inches, and the four jawed chucks range from six to thirty inches. An improved jaw is used in these chucks, which admits of being ground perfectly true after all the parts are assembled. This operation is rendered necessary by the liability of iron to change its form during the process of case-hardening. In this establishment, nothing but the Horton chuck is made, and only the best machinery and best workmen are employed.

The larger view in our engraving represents the general machine shop, in which the greater portion of the work is done. The machines in which the operations of turning, boring, drilling, and screw cutting are carried are shown in the foreground of the view. Fig. 2 shows the machines for cutting the screws employed to operate the jaws of the chucks. Fig. 3 shows the machine for grinding the jaws of the chucks after they are put together; and Fig. 4 represents the department in which the chucks are packed preparatory to shipping them to all parts of the world.

The manufacture of these chucks was commenced in 1855 by Messrs. E. Horton & Son, and was continued by that firm until the death of the son, when the style of the firm was changed to The E. Horton & Son Company, E. Horton being chosen president, and E. B. Bailey, secretary and treasurer.

In March, 1880, owing to the death of Mr. E. Horton, the inventor of the chuck, the company was reorganized, Mr. J. H. Hayden being elected president, Mr. E. B. Bailey, secretary and treasurer, and Mr. Dwight Slate, of Hartford, Conn., superintendent of the mechanical department.



THE MANUFACTURE OF UNIVERSAL CHUCKS.—THE E. HORTON & SON COMPANY WINDSOR LOCKS, CONN.

The company is constantly making improvements and adopting anything that is new and calculated to improve the value of the chucks. Their foreman, Mr. Knight, has given the benefit of a long experience in this line of manufacture, and attends personally to the difficult parts of the work.

The officers of this company are all well known business men, and it is their determination to keep up the standard and reputation of the chucks.

We are informed that the number of orders is increasing from year to year, and that these goods are sent to all parts of Europe, to China, India, Japan, South Africa, South America, and Mexico.

GREAT YIELD OF A BLAST FURNACE.

Furnace B of the plant now in process of completion at the Edgar Thompson Steel Works, Pittsburg, Pa., has recently made a record unparalleled by any blast furnace in the world. The following is the yield in pig metal for seven consecutive days in May: Saturday, 148 tons; Sunday, 156 tons; Monday, 184 tons; Tuesday, 169 tons; Wednesday, 165 tons; Thursday, 166 tons; Friday, 154 tons. Total, 1,141 tons, or an average daily (24 hours) production of 163 tons. Furnace B is 80 feet high and 20 feet in the bosh, and in general design does not differ materially in its lines from other blast furnaces. In its appointments, however, furnace B is especially notable for the heating capacity of the stoves and the power of its blast. The ores used were not especially rich, averaging less than 60 per cent during the period of this enormous run. Hitherto the best record of the "Lucy" furnace, Pittsburg, Pa.—143 tons—was considered a remarkably good day's work, but furnace B, to use a Western expression, "takes the horns." During March last the product of the rail mill of the above steel works was 9,338 tons finished steel rails, or just about 1,000 miles.

A Shower of Railroad Spikes.

The great demand for railroad spikes has called into existence a remarkable machine, now in successful operation at the establishment of Dilworth, Porter & Co., Pittsburg. It is the invention of the late Mr. James Swett, and comprises a series of "continuous" rolls handling the material automatically. The material, in the form of billets two and a half inches in diameter and three and a half feet long, is taken in by the machine, and in thirteen seconds reduced in diameter and increased in length to a rod thirty-six feet long and nine-sixteenths of an inch square. In forty seconds more this rod has to be cut in two and passed through two spike machines, from which finished spikes shower at the rate of forty tons every ten working hours. By working "double time" five of these machines have turned out eleven hundred kegs of railroad spikes per day, each keg containing one hundred and fifty pounds, or thirteen kegs to the ton. The product of ordinary rolls and machines is from two to two and a half tons of finished spikes per working day of ten hours.

The Brewers' Association.

In his annual address as president of the American Brewers' Association, which met in Buffalo, N. Y., June 2, Mr. Henry H. Rueter said that the revenue collected from brewers and dealers in malt liquors during the last fiscal year amounted to $10,729,320, or nearly $800,000 more than for the year preceding. Since 1863 the internal revenue tax on malt liquors has amounted to $120,416,863.67. A committee report was read showing that the decrease of importation of foreign beer for the year 1879, as compared with 1875, was over 1,269,000 gallons, while the exportation of American beer for 1879 exceeded that of 1875 by over $216,000 in value; also that the brewing establishments of the country now number over 3,000, and annually consume 35,000,000 bushels of barley and 35,000,000 pounds of hops.

Charcoal and its Uses.

Charcoal, laid flat while cold on a burn, causes the pain to abate immediately; by leaving it on for an hour the burn seems almost healed when the burn is superficial. And charcoal is valuable for many other purposes. Tainted meat, surrounded with it, is sweetened; strewn over heaps of decomposed pelts, or over dead animals, it prevents any unpleasant odor. Foul water is purified by it. It is a great disinfectant, and sweetens offensive air if placed in shallow trays around apartments. It is so very porous in its "minute interior," it absorbs and condenses gases most rapidly. One cubic inch of fresh charcoal will absorb nearly one hundred inches of gaseous ammonia. Charcoal forms an unrivaled poultice for malignant wounds and sores, often corroding away dead flesh, reducing it to one-quarter in six hours. In cases of what we call proud flesh it is invaluable. It gives no disagreeable odor, corrodes no metal, hurts no texture, injures no color, is a simple and safe sweetener and disinfectant. A teaspoonful of charcoal, in half a glass of water, often relieves a sick headache; it absorbs the gases and relieves the distended stomach pressing against the nerves, which extend from the stomach to the head. It often relieves constipation, pain, or heartburn.

Rapid Cabling.

A press dispatch of eleven words, announcing the result of the recent Derby race, was filed at the office of the Direct Cable Company in London at 10:43 A.M., New York time, and reached this city at 10:43:25, the time of transmission from London to New York being 25 seconds

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year postage included $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address

MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

Is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, JUNE 19, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 233.
For the Week ending June 19, 1880.

Price 10 cents. For sale by all newsdealers.

THE PROBLEM OF THE ICE SUPPLY FOR NEW YORK CITY.

The actual cost of cutting and storing ice during an ordinary winter is said by experienced Hudson River ice men to average about twenty cents a ton. There is a considerable shrinkage while the ice remains in the store house. In breaking out and loading a further loss is experienced. A third loss occurs in the course of transportation to markets; still another in transferring the ice to the delivery wagon; last, though by no means the least, comes the wastage during delivery, especially to small consumers. When the handlings are many, the transportation far, and the weather warm, the loss by melting and breaking reduces the original stock one half. In bringing ice from a distance by sea in schooners of three or four hundred tons burden, such as are employed in the transportation of ice from Maine to this city, the wastage on the voyage amounts to about one-third. It must be remembered also that ice is bulky and heavy as well as cheap, and freightage soon equals the original cost. And with a commodity so perishable, the shipper's margin of profit must be large to cover the risk.

Accordingly the small consumer of ice must expect to pay, under the most favorable circumstances, several times the first cost of it. And unfortunately the conditions of the trade are such that a few large companies, too often a single company, may have a practical monopoly of the trade of a city, and will take every opportunity to put the price up to the highest that individual consumers can be made to pay. Thus the Knickerbocker Ice Company was able, a few years ago, to charge large consumers twenty dollars a ton and families twice as much, or two dollars a hundredweight. The open winter just past is made the occasion of something like an ice famine in this city, and the price is pushed up to ten dollars a ton, though excellent ice is sold at the store houses of the Kennebec for one dollar a ton, and twice as much more will bring it to this city and deliver it with profit, allowing an ample margin for transportation, wastage, and risk.

At such times of high prices, whether due to a real failure of the ice crop or to the natural disposition of monopolists to make the most of their opportunities, the question of artificial production usually comes up. New York manufactures ice making machinery for use in other places; why is it not employed here, and the trade, or rather the public, relieved of the hazards of open winters?

The only reason that we can discover for this state of things is the sufficient one that, in its present state of development, ice-making machinery is not able to compete with Jack Frost in our climate. To be successful financially the manufacture of artificial ice, it would seem, must at present be carried on only where natural ice rarely or never forms, where water is abundant and cheap, and at points so distant from the sources of supply of natural ice, or so unfavorably situated with respect to transportation facilities, as to make natural ice practically unattainable, or at best, very dear.

From the best information that we have been able to obtain the cost of artificial ice has never, under the most favorable conditions in actual practice, been reduced below one dollar a ton, and two dollars is probably nearer the actual cost. It is even doubtful whether a process capable of yielding ice at the lower rate given could be successfully employed to compete with natural ice in this market. If, to save transportation and shrinkage, the work were attempted within the city limits, the price of the water necessary to be employed would go far by itself to cover the cost of natural ice in an ordinary season; since for every ton of ice made there would be required from fifteen to twenty tons of croton water simply to carry off the heat to be withdrawn from the water frozen.

And it must be remembered that the production of artificial ice as an industry must be able to compete with nature, not merely in exceptional seasons, but at all times.

By the adoption of artesian well-water for freezing, and the employment of the current of the East or the North River for cooling, as proposed by Mr. Rankin, this element of the cost of artificial ice might be materially reduced; yet even then there are grave reasons for doubting the ability of existing machinery to compete in cheapness with nature, especially when we take into account the liberal ground space required in the manufacture of ice on a large scale, and the high rental charged for such space and for wharf privileges in this city. The question is not merely whether ice could be made here so as to sell at a profit at the present market rate, but whether the same investment would not bring a larger quantity of natural ice from northern New York or from Maine, where the crop is always abundant and sure. And the same comparison must be borne in mind with regard to seasons less favorable to artificial ice, and they are the great majority, when the Hudson yields its usual supply and the market price is correspondingly low. The ice trade of the north, however, is an enormous one; and, though our ice-makers are unable as yet to wrest it from the harvesters of the natural crop, it is well worth working for. The production of ice-making machinery is still in its infancy; and so long as it is theoretically possible to make ice for less than a dollar a ton in or near our great cities, just so long inventors will have in this a promising field to work in.

The obvious advantage of an ice manufactory near the market place, in saving the expense and loss incident to winter storage, transportation, and repeated handling, makes it possible for artificial ice to compete successfully with winter ice, even when the first cost is several times that

of cutting and housing the natural product. The sanitary advantage of ice frozen from pure water, over ordinary river and pond ice, is another important item in its favor, and one which will reconcile intelligent consumers, if necessary, to a price measurably exceeding that of natural ice.

Whether the cheaper water and cheaper land obtainable at a distance from the market place would more than offset the expense and wastage involved in transportation and extra handling is a matter to be determined. It may be that the most economical place for ice manufacture for New York consumption, all things considered, would be up the Hudson where the water is sweet, perhaps above the State dam at Troy. Ground space opposite or above Lansingburg would be comparatively inexpensive. The water could be drawn from the river and would be uncontaminated by the sewage of Albany, Troy, and the adjacent towns, as would be the case if the works were located further down the river. The condensing or cooling coils could be submerged in the river, and one of the chief items of cost in the production of ice artificially would thus be avoided. The ice as fast as manufactured could be placed on river barges such as are now employed in the trade, and the daily product could be towed down the river cheaply and with comparatively slight wastage. If the claims advanced by the makers of ice-machinery are veritable in practice on a large scale there ought to be a good margin for profit in an undertaking of this character. If existing machinery will not justify the experiment—and we do not see why capitalists are neglecting it if the opportunity is real—then our inventors should look to it. As already remarked, the field is wide and inviting.

THE MILLERS IN COUNCIL.

The Millers' International Exhibition at Cincinnati, for which preparations have been making for many months, was opened on the 31st ult. It presents undoubtedly the completest display of milling machinery in full operation, and all appliances connected with the trade, together with the largest collection of different varieties of grain and flour, that has ever been brought together in this or any other country. The Millers' National Association fixed the time of holding their annual convention for the first week of the Exhibition, as the latter is to last four weeks, and besides a full attendance of members of the trade from all parts of the United States, an imposing delegation of the leading millers of Great Britain, France, Germany, and Austria, are in attendance.

For many reasons this Exhibition and the assembling of representative millers from all parts of the world is of the utmost significance at the present time. Our exports of wheat for the nine months to the 1st of April last amounted to $149,012,740, and in wheat flour the exports for the same period were valued at $26,375,228. The quantities were smaller, although the proportions were about the same for the like period of the year preceding. The question immediately arises: Is it not possible for our millers to largely increase the quantity of flour, in proportion to wheat exported? To do this would be by so much to enlarge the field for the employment of American labor and capital. Perhaps the most important object of the Exhibition, however, and it is intimately connected with the above question, is the comparison of the methods of milling adopted in various countries. And here we find a very complicated state of affairs; indeed if this were not so it is hardly probable that so influential a delegation of foreign millers would have come across the ocean to see what our millers are doing. It is the habit of American manufacturers, mechanics, and artisans, to perfect their own processes partly by watching closely what every one else is doing in the same line, either at home or abroad; but it is generally the rule with foreigners to scout the idea that anything can be learned in regard to the older trades from our experience. Now, however, these foreign millers want to find out something about the making of our new process flour; they want to know something about the improvements we have been making in milling for the past ten years, whereby our millers have rendered it a task of constantly increasing difficulty for them to hold the business of making flour for their own markets. And the welcome extended to them, and the facilities they are afforded for examining the machinery and looking into the workings of all our large establishments, present a striking contrast to the exclusiveness which most foreign manufacturers maintain toward all would-be visitors.

Just what the new process is it would be impossible to define specifically, for what might be the new process with one establishment may have become substantially an old one with another. The business has been constantly changing within the past few years, the general direction of the movement having been toward the introduction of chilled iron rolls operating in connection with the burr stones, and reducing the wheat two, three, or more times, instead of once, as formerly. Hardly any two millers agree exactly as to what is the best method, but there is a general concurrence of opinion among the leading members of the trade that the plan of gradual reduction, with repeated purifications and regrindings, is the best, although, in thus making a smaller proportion of flour of the finest grades, they have a large proportion of other products, which it will take some time to generally classify. Of all these methods, however, foreign millers will have an excellent opportunity to judge, while our own millers will undoubtedly make the most of an examination of several full sets of English and German milling machinery shown at the Exhibition, as well as obtain much valuable information from a comparison of views with so many of the leading representatives of the trade abroad. Among the mechanical features which are likely to receive particular attention, the magnetic separator, for removing all iron particles from the wheat, is one of the newest. It is astonishing in what a variety of shapes iron finds its way into the wheat, not only from the wire used in binding, but in the way of nails, pins, pieces of reapers, etc., and even as ore dust from wheat lands of this character. The damage heretofore done to the stones and bolting cloths from this cause has been great, and many fires have been caused thereby. Our elevator system of handling grain will likewise be of particular interest to our foreign visitors, where our methods of handling and storing are almost unknown. But, while they will give no little attention to the various differences of classification, and while the conceded objects of both foreign and American millers at this meeting are to discover how best to make the purest and finest flours, we hope the opportunity will not be allowed to pass for these representatives of the trade to properly stigmatize the not unusual practices which have grown up of late in adulterating flour. The mixture of white corn or barley flour with wheat flour is now done by some millers to an extent which would perhaps quite counterbalance the improvement made by others in the quality of their product, while it is well known that alum is used to some extent. For the credit of the trade, as well as for the benefit of the community, we hope that such practices will receive their deserved rebuke, and if possible effectual exposure, at the hands of the millers assembled in Cincinnati.

THE HOWGATE POLAR EXPEDITION.

The steamer to convey the Howgate colony to the Arctic regions has been overhauled and specially strengthened for the service at Alexandria, Va., and has received her outfit at the Washington Navy Yard, preparatory to sailing June 10. The chosen vessel is the Gulnare, a Clyde built steamer of 290 tons.

She is 140 feet in length, and 21 feet 6 inches breadth. The engine is 200 horse power, and has two 30 inch cylinders, each 24 inches stroke. Additional strength has been given by filling in 2½ inch oaken plank between the iron frames and sheathing inside and outside with stout oaken planks, thus making the hull uniformly 15 inches thick. The inside of the hull has been braced with extra heavy white oak timbers placed horizontally. Three heavy white oak breast hooks have been placed inside of the prow, and on the outside of the bow is a sheathing, three-eighths of an inch of iron armor, extending 10 feet deep and 14 feet aft from the stern. In addition on the sides of the vessel extending above the water line there have been placed wedge-shaped oak timbers to be used in easing the vessel upward when pressed by heavy ice. A new main deck has been constructed, and a new smokestack and an extra propeller provided. A new bridge 21 feet long has been placed amidships. The forward part of the vessel will be used for the seamen. Aft of the engine and boiler is the cabin, with staterooms which will accommodate the officers and scientists. The Gulnare will carry in addition to her steam power mainmasts and foremasts and duplicate sets of new sails.

Accommodations are provided for forty persons, twenty-five of whom comprise the polar colony, consisting of Lieut. A. W. Greely, Fifth United States cavalry, commander, with, as assistants, Lieut. G. C. Doane, Second United States cavalry; Lieut. W. H. Low, Twentieth United States Infantry; Henry Clay (grandson of Henry Clay); Astronomer —Orray Taft Sherman, who was connected with the Florence Expedition, and as assistants, George H. Rohie, W. S. Jewell, and O. Aldrich, of the Signal Corps United States Army; Surgeon and Naturalist, Dr. Octave Pavy; Photographer, J. W. Rice; and fourteen enlisted men as a working party. In addition to these two half-breeds have been engaged as dog drivers, and will join the vessel at a place called Rigolette, on the coast of Labrador.

The steamer carries two years' supply of provisions for the colony, and rations for the ship's crew for sixteen months, though it is expected that the voyage will be made in five months. A double walled frame house, 21 x 65 feet inside, is carried for the colony, besides the usual outfit for traveling parties. The station will be provided with a steam yawl and two whaleboats for water exploration, and six sledges, with dogs, for land work. It is expected that fuel will be obtained from a coal vein at the site of the proposed station.

The outfit includes the following scientific apparatus, in addition to a proper supply of surgical and medical instruments and appliances.

Meteorological.—12 spirit thermometers, 12 mercurial thermometers, 12 maximum thermometers, spirit; 3 maximum thermometers, mercurial; 6 psychrometers, mercurial; 6 psychrometers, spirit; 12 minimum thermometers, spirit; 6 black bulb thermometers, in vacuo; 6 black bulb thermometers, free; 1 Regnault's hygrometer, dewpoint apparatus; 3 rain gauges, 6 standard barometers, 6 aneroid barometers, 6 anemometers, standard; 3 self-registers for anemometers, 3 wind vanes, 6 water thermometers, in cases, complete.

Astronomical.—3 sextants, 6 chronometers, 2 magnetometers, 2 fox circles, 6 telescopes, 6 binoculars, 2 spectroscopes, 4 heliographs, 4 sets drawing instruments, 6 sets signal equipments. In addition to a well selected collection scientific works, and an unusually fine collection of Arctic works, a large quantity of miscellaneous reading matter has been contributed by friends of the expedition.

On leaving Washington the Gulnare will proceed under sail (to save fuel) to St. Johns, N. F., where she will stop for additional coal and an ice pilot and any further supplies that may be needed.

From St. Johns the vessel will go to Rigolette and take on board the dog drivers and the sledge dogs, which are expected to be ready for the expedition. From Rigolette she will go to Disco, using steam only when absolutely necessary.

At Disco the coal bunkers will be refilled from the supply left by the Polaris, or, failing that, from the Danish stores, and then the vessel will be pushed forward as rapidly as possible to Lady Franklin Bay, where the colony and outfit will be landed. If weather and water prove favorable the vessel will return to the United States with as much speed as practicable. It is expected that she will reach Washington on her return by the middle of October.

OUR IRON AND STEEL IMPORTS.

The recent labor troubles in the iron industry of Western Pennsylvania give especial interest to the figures furnished by the United States Bureau of Statistics, relative to our increased imports of iron and its manufactures. Without touching at all upon the merits of the questions at issue, from the laborers' point of view, the practical one, which concerns consumers as well as producers—the price at which iron and its manufactures can be maintained and meet with the largest market for the product of the mills—meets here a significant answer. The imports of this class are all dutiable, and there seems to be now no probability that we shall have any change in the tariff thereon during the present session of Congress. Yet, notwithstanding these duties, our imports of iron and its principal manufactures have increased enormously within the past few months. The "boom" in the iron industry, which, so short a time ago, seemed to promise an extremely active business throughout all of 1880, at prices that were "out of sight" of those obtainable a year ago, has entirely subsided, and, with the flood of foreign goods which has been coming in, prices have so declined that it is evident, even with the enormous consumptive demand we are having, that fancy figures will not be obtainable hereafter. The iron manufacturers here will have to compete with those abroad, with the advantages of the tariff in our favor, it is true, but with heavy stocks, lower rates for wages, and more abundant and cheaper capital to the credit of the other side of the account.

In the three-quarters of a year preceding April 1, 1879, our imports of pig iron amounted to only $1,306,700; for a like period to April 1, 1880, they were $7,291,458, but the price of American pig in New York the first of this year was $35 per ton, against $17 per ton the 1st of January, 1879. The imports of old and scrap iron for the first mentioned period were but $66,967, but for the corresponding nine months a year later they were $6,705,190. In steel ingots, bars, sheets, and wire, we took from foreign manufacturers in the first period to the value of $837,631, against $2,463,127 in nine months a year later; in bar iron we bought $1,037,205 in the former, as against $3,150,606 in the latter period; and in miscellaneous manufactures of iron and steel the imports stand at $1,595,020 for the nine months to April 1, 1879, against $3,416,065 for a similar period to April 1, this year. A corresponding increase was also experienced in imports of boiler iron, band and hoop iron, railroad bars of iron and steel, sheet iron, hardware, anchors, cables and chains of all kinds, machinery, and cutlery, and there was even an increase in our imports of firearms, which amounted to $460,426 for the former as against $608,072 for the latter period. The only articles not reported as showing an increase are saws and tools and general castings, of which our importations were insignificant during both periods.

We have here given the figures relating to only one of our leading industries, although in many other branches of business like comparisons present themselves. In none, however, are the extremes more conspicuous, both as to prices and the increased imports, than in this department. This comes naturally enough, probably, from the great activity in railroad building, and from the wonderful growth experienced in nearly every branch of manufactures, but our ironmasters already see that extreme profits and speculative prices cannot be hereafter obtained. From a general point of view the situation is in every way encouraging, for our enormous exports of grain, provisions, and cotton still turn the balance of trade in our favor; money is abundant and cheap in all the leading centers, trade is the more healthy for the diminished tendency to speculation, and there is everywhere plenty to do for those who are willing and able to work; but, our money being good now all over the world, the standards of value here for manufactured goods must inevitably bear a fixed and definite relation to the prices obtained for like articles in the leading foreign markets.

The Millers' National Association.

At the meeting of the Millers' National Association, in Cincinnati, June 2, in connection with the Millers' International Exhibition, Mr. Alexander H. Smith, chairman of the committee on patents, advocated more liberal appropriations by Congress to the Patent Office, the abolition of the reissue of patents under new titles, the establishment of a patent court, and reforms with reference to rules for estimating damages in cases of infringement. At the same time Mr. Smith took occasion to denounce "the thieves who steal foreign processes and patent them in this country."

Sir Joseph Whitworth.

At the late meeting of the British Iron and Steel Institute in London, the Bessemer Medal for 1880 was conferred upon Sir Joseph Whitworth, whose successes as a mechanician have earned for him a world-wide reputation.

Sir Joseph was born December 21, 1803, at Stockport, Cheshire, England. At the age of fourteen he entered his uncle's cotton mill in Derbyshire; and in 1821 he proceeded to Manchester, where he spent four years in the machine shops of Crighton & Co. and others. He afterwards spent several years in noted London workshops. In 1833 he returned to Manchester, and started business on his own account as a manufacturer of engineers' tools. It was here that he first became generally known for superior workmanship and for his inventions for the improvement of machinery, the production of true surfaces, etc. His theories on the latter score were announced in a paper read before the British Association at Glasgow in 1840, and during the next ten years he was able to carry them out practically in various mechanical inventions and improvements, among them the duplex lathe, the reversing tool of the planing machine, interchangeable nuts and screws, and standard gauges. His tools achieved especial distinction at the great Exhibition of 1851, where he received the Council Medal for a measuring machine of wonderful delicacy and exactness. He was one of the Royal Commissioners to the World's Fair in this city in 1853, and on his return he undertook for the British Government the construction of machinery for the improved production of firearms. Since that time he has been one of the leading exponents of the science of gunnery.

He was elected Fellow of the Royal Society in 1857, and has won several grand prizes at international exhibitions for improvement in cannon and in the working of steel. His strongest claim for permanent favor and honor rests, however, upon the "Whitworth Scholarships," which he founded in 1869 for the encouragement of mechanical and engineering science. These scholarships are thirty in number, of $500 a year each, and tenable for three years by successful competitors in certain specified mechanical subjects.

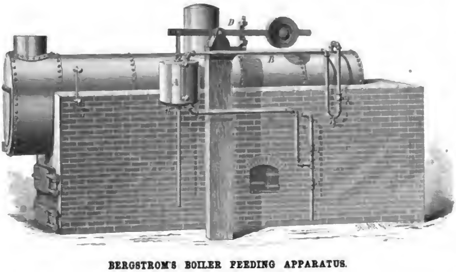
Another Mathematical Prodigy.

An eleven year old boy, Jacques Inaudi by name, is astonishing the French with his marvelous faculty of reckoning. He can neither read nor write. His calculating power appears to rival that of Jedediah Buxton, Henri Mondeux, Colburn, and others of the class.

AUTOMATIC FEED WATER APPARATUS FOR STEAM BOILERS.

The annexed engraving shows an improved apparatus for regulating the supply of water fed to steam boilers. It operates by gravity of water contained in a movable tank connected with the boiler by two pipes, one above, the other below the water line. A rod connects the movable tank with the valve of a feed pump, or with the throttle valve of a steam pump, if a steam pump be used.

In the engraving, A is the tank, connected with the boiler by pipes, B C, the pipe, B, entering the boiler at the top or at any other convenient point above the water line, while the pipe, C, enters anywhere below the water line. The weight of the tank, A, and the water contained by it are supported by a weighted lever, D, which is adjusted so that, when the boiler is properly filled with water, the weight on the lever will be overbalanced, and the tank, A, will rest in its lowest position; but when the water level in the boiler is abnormally low the level of the water in the tank, A, is correspondingly lowered, and the tank is thereby made lighter, when the weight on the lever, D, preponderates and raises the tank, A. The movement of the tank, A, both up and down is limited by two screws in an arm projecting from the framework supporting the lever, D. The motion of the tank, A, is made available in regulating the amount of water supplied to the boiler by connecting the tank by means of a rod with a valve in the boiler feed pipe, or with the throttle valve of a steam pump, or with the valves of an injector, all depending, of course, on the particular method of feeding the boiler. When the tank rises it opens the valve and allows the water to flow into the boiler; when it descends the valve is wholly or



BERGSTROM'S BOILER FEEDING APPARATUS.

partly closed, and the feeding is checked. By means of this device, the inventor says, the water level in a boiler can be perfectly maintained without special attention, and it makes no difference whether the water foams or is perfectly quiet, the weight of the water contained by the tank, A, is depended on, and not its seeming bulk. It is claimed that this device is far more reliable than gauge cocks or water gauges.

This device is supplied with valves by means of which it may at any time be blown off and cleaned. We are informed that one of these boiler feeders has been in use on a boiler in Red Wing, Minn., for the past ten months, and has been subjected to every possible test, and has proved reliable under all circumstances.

Further information may be obtained by addressing Mr. Henry Bergstrom, Red Wing, Minn.

CLIMBING APPARATUS.

A sailor is in his element when climbing to the top of a high mast, and experiences no more trouble in reaching the top of the mast than we do in going to the attic of our dwelling. Such gymnastic exercises are, however, not in the province of the engineer, and whenever he has to execute any work upon any object situated at a certain height, his

CLIMBING APPARATUS.

only means of ascending to it are by ladders or stages. The latter are, of course, only used where the expenses of such a structure may be incurred, and not at all suitable for reaching the top of ordinary poles or masts. In such a case ladders are generally employed, as being the only means available, but the lateral pressure upon any high post of a long and necessarily heavy ladder is very great, and its employment in such cases not devoid of danger. As nowadays telegraph poles are erected all over the country, and since the introduction of the telephone, often in situations difficult of access with a ladder, it becomes a matter of considerable importance to engineers to be able to reach the top of these posts with ease in order to be able to execute there the work which falls to their share, and upon the solidity and reliability of which very often many important matters depend. To facilitate the ascension of these posts a Swedish engineer has invented the climbing device shown in our illustration.

The principal part of the apparatus consists of a shoe attached to the foot—something in the manner of skates. It consists of an iron sole plate, which is attached by means of bolts and clips to a steel bar; to the sole are fixed the straps and rings, while the end of the steel bar is turned up at the end to form a cap. To the outer end of this bar two curved arms are hinged in such a manner that their points remain always a certain distance apart.

When the apparatus is to be used the soles are buckled to the feet of the operator, and there must, of course, be a pair of these apparatus with the curved arms set to opposite sides; the man then lifts one foot up after another by holding the foot so that the bar, shown while fixed in a vertical position, is thrown into a horizontal one; this enables the two curved arms to open and to encircle the post, when, by pressing the foot down, they will support the body. Thus one step after another may be taken until the arrival at the required height.

In order to give the operator steadiness, and to free the hands for the necessary work, the operator has a belt attached to his waist which also carries a ring which is capable of sliding along the post. By a simple adjustment the curved arms can be adjusted to the average diameter of the post to be ascended.—*Design and Work.*

NEW INVENTIONS.

Mr. Theodore Soppes, of Buffalo, Ill., has patented an improved washing machine, which is simple in construction, easily operated, and effective in operation, washing the clothes evenly, quickly, and thoroughly.

Messrs. Joel H. Prouty and Solon S. Sprague, of Worcester, Mass., have patented an improved burr roll for loom temples, which consists of a hollow roll whose body and periphery are one, being formed of sheet metal, which is provided with triangular teeth formed by cutting V-shaped slits in the metal and striking up the pieces thus partly severed from the sheet, while the ends of the roll are provided with openings for insertion of fibrous packing material and of the lubricant for the bearings of the cylinder.

Mr. Rolla R. Jones, of Watertown, N. Y., has invented an improvement in pliers. The object of this invention is to furnish pliers so constructed that they may receive different tools, and that the heads can be removed and replaced as required.

Mr. George W. Terry, of Prescott, Ark., has patented a self-calculating register for postage stamps designed for use in fourth-class post offices, where a daily transcript of the number of stamps canceled has to be kept and forwarded to the department as a part of the quarterly returns, the use of which registers will save a great deal of time and labor in keeping the account.

Mr. Robert Cunningham, of New York city, has patented an improved process of manufacturing articles in imitation of papier mache, consisting in coating the surface of the article with transparent varnish, in then depositing thereon the ornament and allowing it to become fixed, and in then applying over the ornament and its support a covering of transparent varnish and allowing it to become dry.

A device for holding scrubbing, whitewash, and other brushes while in use, so as to permit the convenient and free manipulation of the brush, has been patented by Mr. Eugene B. Randolph, of East Millstone, N. J.

Dust Fires.

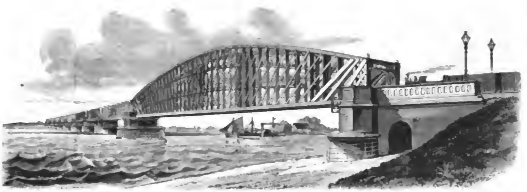
A gentleman at Appleton, Wis., communicates to the *American Miller* his experience, which shows, as we all know, that other kinds of dust besides flour are explosive under certain conditions. He says: The loft of my spoke mill, in this city, was wholly used as a finishing room, where the spoke was finished, and polished by contact with rapidly revolving sanded belts. In it was a square or box stove, used for warming purposes. The light, fine dust would accumulate in every crack and crevice of the room, requiring cleaning off every day. One day some of this dust was seen to fall from a rafter upon some live coals that had accidentally got out upon the hearth of the stove. Instantly there was a flash that filled the whole loft, and it was on fire in a hundred different places.

It was with the most active exertions that the fire was subdued, and not without a considerable damage to the building and stock. I believe the air was strongly impregnated with gas evolved by friction; and that the explosion and fire occurring in flour mills are precisely of the same nature and due to the same causes.

STRUCK BY LIGHTNING WHILE UNDER WATER.—At Halifax, N. S., May 20, while divers were at work at Cole Harbor dike a storm came upon them, and the lightning striking an air pump passed down to a diver under the water. When brought up he was insensible, but his injuries are not serious.

THE KUILENBURG BRIDGE.

The Utrecht Boxtel line of State railways in the Netherlands crosses three large rivers, the Lek, the Waal, and the Maas, within a distance of ten miles, the bridges at these points being known by the respective names of the Kuilenburg, the Bommel, and the Crèvecœur viaducts. The great lengths of these bridges, the nature of the streams that they cross, and the local circumstances necessitated engineering skill of a high class. The conditions of the foundations were such as to require piling. The piles varied from twenty-three to fifty-three feet in length, being driven in some cases by the ordinary pile-driving engine, and in others by a steam ram. After the piles were cut off to a level below water, the space between them was filled with beton or concrete, projecting from three to five and a half feet beyond the footings of the masonry above, and varying from eleven to twenty-one feet in thickness. The tops of the piles were completely floored over, and masonry built up, well bonded on to the floors to prevent sliding by longitudinal and cross walings of oak, and the faces of piers and ice-breakers were finished in Belgian ashlar. The footings of the piers were thoroughly protected by a close row of long piles to each, and heavy rip-rapping of rough stone.



BRIDGE AT KUILENBURG, DEPARTMENT OF THE NETHERLANDS.

The superstructure of the Kuilenburg bridge (shown in the engraving) was built by the well known Dutch firm of Harcort & Co., under the superintendence of Mr. N. T. Michaëlis, engineer-in-chief. It consists of nine spans, entirely of wrought iron construction, there being one span of 492 feet clear opening, one of 262 feet 6 inches, and seven of 187 feet each, making, with the widths of piers, a total length between the faces of abutments of 2,181 feet. The bridge consists of two open trusses, built of riveted plates and angles, the upper and lower flanges being formed in the shape of double Ts, side by side, the inclined ties of thin rectangular bars, except toward the centers of spans, where they require stiffening for compression under variable load, and the vertical struts of I shape, some of the largest being strengthened by the introduction of two series of channel bars between the verticals. The trusses are placed so as to give a clear width of roadway of 27 feet, and height of 16 feet 5 inches, the structure being a *through* bridge. Cross girders 2 feet 11¼ inches deep connect the main trusses, and the whole is well stiffened by a thorough system of lateral and diagonal bracing. The span of 492 feet has a parabolic upper member, the depth of truss in center being 35·6 feet, and at the ends 26·24 feet. The other spans have rectangular trusses of the same depth as the ends of the parabolic truss.

All holes for riveting were drilled, no punching being allowed in the work. The bridge is built for double track, there being only a single track placed on at present. Two footpaths are provided for the service of administration. The total weight of material in the structure is as follows:

Wrought iron	4,394$\frac{6}{10}$	tons.
Bessemer steel	610$\frac{7}{10}$	"
Cast iron	30	"
Lead	3$\frac{2}{10}$	"

There were also 8,000 cubic feet of oak, 9,500 cubic feet of timber used, and 350 tons of plates placed between them of fir to form the floor of the bridge. The total cost of the structure was upwards of $1,187,100.

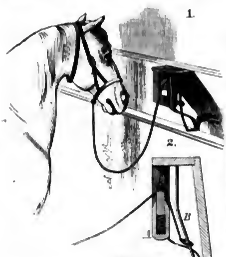
SAFETY APPLIANCE FOR RELEASING HORSES.

We give an engraving of a new safety device to be applied to the manger or some part of the stall to which horses are usually hitched. It consists in a device for cutting the halter should the horse become entangled in it.

Fig. 1 is a perspective view showing the exterior of the appliance, and Fig. 2 is a vertical section showing the arrangement of the several parts.

A hollow casting, A, is secured to the manger, and contains a spring-acted follower, C, which supports the halter and prevents it from coming into contact with the sharp edges of the casting, A, when no extraordinary strain is put upon the halter. The end of the halter is attached to a ring capable of sliding up and down on the rod, B. Should the horse become entangled so as to press down upon the halter, the follower in the casting, A, will be pressed down, allowing the halter to come into contact with the sharp edges of the casting and be instantly severed. It will be seen that so long as the halter fulfills its regular office it will not be cut, as the spring follower then holds it away from the cutting edges.

This invention was recently patented by Mr. Benjamin F. Strange, of Corvallis, Montana Ter.



STRANGE'S SAFETY HITCHING APPLIANCE.

SLED AND BOAT COMBINED.

The annexed engraving represents a novel gondola sled lately patented by Mr. James H. Dennis, of Newark, N. J. It is in reality a combined sleigh and boat, well adapted to both sleighing and boating purposes. Its construction will be readily understood from the engraving. The body or boat is similar in form to that of an ordinary row boat. It is provided with transverse seats, and may be made of sufficient size to contain several persons.

The sled is propelled by a set of sweeps arranged in rowlocks and operated like oars. The sweeps are slotted to receive the pins of the rowlocks, and the ends of the sweeps are provided with serrated steel ends or claws which engage the surface of the ice as the sled is propelled. When the device is used as a boat these serrated ends may be removed and paddle blades attached in their stead.

At the rear of the boat there is a wheel used for steering the sled on the ice, and it answers equally well for a rudder for the boat when it floats in the water. A brake is attached to the rear to retard the motion of the sled; it may also be used to assist in steering.

This gondola sled affords a means of enjoyable winter exercise which may be participated in by a party of persons, and no very great exertion is required to get up an astonishing speed on smooth hard ice. The double character of the sled renders it perfectly safe even on thin ice, as it answers the purpose of a boat as well as of a sled.

Further information may be obtained by addressing Mr. James H. Dennis, care of O. B. Wilson, 23 Cedar street, New York city.

DENNIS' GONDOLA SLED.

CALENDAR INKSTAND.

The engraving represents an inkstand provided with a calendar that requires changing but once a month to render it perpetual. It makes a handsome article of desk furniture, and as a calendar it is always in the right place. To change the adjustment is but the work of a moment; it is done by unscrewing a nut at the bottom of the stand, and turning the ink fount around until the days of the week are directly over the spaces containing the figures representing the proper days of the month. For example, if Tuesday is the last day of September, then Wednesday being the first day of October, the ink fount is turned until Wednesday is over the column beginning with figure 1. This useful article may be made either wholly of glass or partly of glass and partly of metal or wholly of metal.

PERPETUAL CALENDAR INKSTAND.

For further information, address Mr. S. M. Howard, administrator, 1207 Main street, Wheeling, W. Va., and see advertisement in another column.

THE result of the great English Derby race was cabled from London to New York in just twenty-five seconds. Tolerably quick work even for lightning.

West Indian Fruits.

I remember a few years ago I was one of a party excursionizing down the Delaware. Our steamer passed an inward-bound schooner sailing up with a flooding tide, "wing and wing." The captain remarked, "There goes a fruiter," when everybody on deck rushed to the side to look at her. Doubtless, open-mouthed crowds, too, overlooked the unloading. How things have changed; here is one firm, Warner & Merritt, who keep twenty-six vessels busy bringing fruit to this port, three of them being steamers (and they talk of building more ships). So cargoes arrive almost daily.

Fruit is generally auctioned off at once upon arrival, if ripe; but if it needs maturing, it goes to the newly-finished warehouse nearly opposite, whose owners now have the satisfaction of having the finest building on the street, as well as the best appointed in the trade; a structure which has grown from small beginnings in so short a lapse of years, that the "trade" is just beginning to realize the fact of its existence.

Passing through the basement, or ground floor, by a devious path between barrels, boxes, and sacks full of oranges, nuts, dates, and what not, we went up to the offices on the second floor, as large and fine in appointments as those of a bank. Telephones to the top floor, to the wharves, to places all over town, to Cuba itself, possibly. A dozen clerks were busy with the multifarious details of the business.

Last week one of the firm was interviewed by a representative of one of the leading dailies with the following result:

"Now," he commenced, "is the opening of the active season. We expect a schooner to arrive on Monday from Jamaica with 6,500 bunches of bananas and 25,000 cocoanuts. In a few days a steamer will be due from Baracoa, Cuba, with 3,500 bunches of bananas and 50,000 cocoanuts."

"Are these bananas red or yellow?" was asked.

"The yellow bananas come from Jamaica and Aspinwall, and the red bananas from Cuba. The yellow bananas sell the best because they grow more to the bunch. A bunch of yellow bananas average about ten dozen, and sometimes they have as many as twenty dozen, while the red bananas seldom run over five dozen. The bunches are sold at about the same price, so the retailers can afford to sell the yellow ones for less and still make a better profit than they can on the red ones. So you see it is a difficult matter for us to sell red bananas when we have many of the yellow."

"Isn't the flavor of the yellow banana considered more delicate than that of the red?"

"By some people I believe it is. The flavor of a banana depends a great deal on the soil in which it is raised. Jamaica is the most favored in this respect; the bananas from Aspinwall are drier and not so rich. The Jamaica fruit is undoubtedly the best.

"We begin to receive pineapples from the Bahamas about the 1st of May, and the trade continues until the middle of July. In that time we receive over two millions of them. They are sold principally to canners and preservers. We shall send at least 300,000 to a canning establishment at Moorestown, N. J. Then the confectioners use a great many to make this candied fruit (glacé, I think they call it), and they consume more and more every year. Pineapples, in my opinion, make the nicest preserve there is."

"Is the demand good now?"

"Very good indeed," the importer went on. "When that shipment arrives we shall have to work a week night and day to get off the orders. We sell all quantities—fifty and a hundred bunch lots of bananas, case lots containing five bunches and even one bunch at a time. We send them all over the country. We very often make large shipments as far west as Missouri."

"Do you do much in California fruits?"

"Yes, in September we sell a good many California pears and grapes. We receive several car loads a week. The grapes, are, as a rule, very good, but I can't say as much for the pears."

"How is the consumption of dates and figs?"

"Very light. We don't sell many dried fruits, now that green fruits can be obtained at all seasons of the year."

"Is there any trade done in limes?"

"Yes, limes are imported later in the season. They are generally pickled or used for making punches. In Europe lime juice is made, and from that a very healthy drink, much preferable to lemonade. A good many are used in California, where they are sent from Mexico."

"May I trouble you to give me the rates fruits are selling for at present?"

"Certainly. Oranges bring from \$3.75 to \$4 per box; lemons from \$4 to \$5; bananas from \$2 to \$3.50 per bunch, according to size; limes from \$6 to \$10 a barrel of from 1,200 to 1,500; pineapples, this season, will wholesale at from \$10 to \$12 per hundred. These prices are about 25 per cent higher than those of last season, and the trade is active and steady. I never knew it to open better than it did this year."

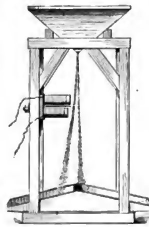
Stepping upon an elevator, we passed upward by one floor after another, each of which held its share of stock, to the top story, where cocoanuts were being desiccated at the rate of 150,000 per month. First leaving the hands of men who chop away the shell with hatchets, and going into the insatiate jaws of a machine which "chaws up" 100 in a minute. Then the snowy flakes are treated to a little sugar and kiln dried, lastly being packed into shapely tin cases bearing a label, "Gorton's Desiccated Cocoanut."

"We are working this department eighteen hours per day," said our guide, "and must shortly put on an all night force to keep up with our orders."

We looked into the refrigerating rooms—warm in winter and cool in summer—where bananas, thousands of bunches, are forced to maturity, or retarded, at will.

EDISON'S ORE SEPARATOR.

We give herewith an engraving illustrating the principle of Mr. Edison's recently patented magnetic ore separator. The device is intended for working tailings which are now thrown away as being too poor to pay for working by any



EDISON'S MAGNETIC ORE SEPARATOR.

of the ordinary methods. The concentration is effected by allowing the sands to fall in front of the face of a large electro-magnet. The magnetic attraction changes the trajectory of the falling magnetic sand without stopping its fall, so that while the silicious sand, gold, and other non-magnetic substances fall straight down into one compartment of the receiving hopper, the trajectory of the magnetic sand is changed so that it falls into another compartment of the receiving hopper.

By this means the separation of the black sand is rapidly and completely effected with the expenditure of very little labor.

IMPROVEMENT IN STOVEPIPE.

We give herewith an engraving of an improvement in stovepipes, which will doubtless receive the approval of all who have had experience in joining and adjusting lengths of stovepipe. New pipe used in any place is scarcely ever right, and old pipe put in a new place is never right. The device shown in the engraving provides for lengthening and shortening the pipe and fastening it securely at any desired degree of extension.

The improvement consists in a cast metal plate, A, provided with a series of sockets, attached to a stovepipe length having a number of slots for receiving the sockets of the casting.

FREEMAN'S EXTENSION STOVEPIPE.

The sockets may be of any depth required to receive the tooth of a dog, B, hinged to the adjacent length of pipe. When the dog enters one of the sockets in the casting the two sections of pipe are firmly locked, and not liable to accidental separation.

This construction admits of any required change in the length of the pipe, and avoids all of the difficulties usually experienced in putting up stovepipe.

The inventor proposes to make the parts of either cast or stamped metal, or to stamp the recesses for receiving the dog, B, in the metal of which the pipe is formed.

Further information in relation to this useful invention may be obtained by addressing the inventor, Mr. W. C. Freeman, Fort Reno, Indian Territory.

Rules for the Management of Steam Boilers.

Engineers and users of steam power will be benefited by keeping in constant mind the following rules which the Hartford Steam Boiler Insurance Company keep posted in the boiler rooms where they have assured risks:

1. *Condition of the Water.*—The first duty of an engineer, when he enters his boiler room in the morning, is to ascertain how many gauges of water there are in his boilers. Never unbank nor replenish the fire until this is done. Accidents have occurred and many boilers have been entirely ruined from neglect of this precaution.

2. *Low Water.*—In case of low water, immediately cover the fire with ashes; or, if no ashes are at hand, use fresh coal. Do not turn on the feed under any circumstances, nor tamper with nor open the safety valve. Let the steam outlets remain as they are.

3. *In Case of Foaming.*—Close the throttle, and keep closed long enough to show true level of water. If that level is sufficiently high, feeding and blowing will usually suffice to correct the evil. In case of violent foamings, caused by dirty water, or change from salt to fresh, or *vice versa*, in addition to the action above stated, check draught and cover fires with fresh coal.

4. *Leaks.*—When leaks are discovered, they should be repaired as soon as possible.

5. *Blowing Off.*—Blow down, under a pressure not exceeding twenty pounds, at least once in two weeks; every Saturday night would be better. In case the feed becomes muddy, blow out six or eight inches every day. Where surface blowcocks are used, they should be often opened for a few moments at a time.

6. *Filling up the Boiler.*—After blowing down, allow the boiler to become cool, before filling up again. Cold water pumped into hot boilers is very injurious, from sudden contraction.

7. *Exterior of Boiler.*—Care should be taken that no water comes in contact with the exterior of the boiler, either from leaky joints or other causes.

8. *Removing Deposit and Sediment.*—In tubular boilers the hand holes should be often opened, and all collections removed from over the fire. Also, when boilers are fed in in front, and blown off through the same pipe, the collection of mud or sediment in the rear end should be often removed.

9. *Safety Valves.*—Raise the safety valves cautiously and frequently, as they are liable to become fast in their seats and useless for the purpose intended.

10. *Safety Valve and Pressure Gauge.*—Should the gauge at any time indicate the limit of pressure allowed by this company, see that the safety valves are blowing off. In case of difference, notify the company's inspector.

11. *Gauge Cocks, Glass Gauges.*—Keep gauge cocks clear and in constant use. Glass gauges should not be relied on altogether.

12. *Blisters.*—When a blister appears there must be no delay in having it carefully examined and trimmed, or patched, as the case may require.

13. *Clean Sheets.*—Particular care should be taken to keep sheets and parts of boilers exposed to the fire perfectly clean; also, all tubes, flues, and connections well swept. This is particularly necessary where wood or soft coal is used as fuel.

14. *General Care of Boilers and Connections.*—Under all circumstances keep the gauges, cocks, etc., clean and in good order, and things generally in and about the engine and boiler room in a neat condition.

Ocean Icebergs.

During a recent passage of the steamer Helvetia from Antwerp to New York, the wind blowing a nice breeze from the westward, a sudden change in the temperature was noticed. An hour before the weather was quite sultry, awnings being spread fore and aft; but at about three o'clock in the afternoon, although the sun was shining brilliantly, a cold blast from the northwest set in. The rapidity of the change from a sweltering summer's day to an Arctic frost naturally caused considerable amazement, especially among the greener members of the crew. The more experienced knew what was coming, and when the cry of "Icebergs on the starboard bow!" followed immediately by the notification that others were visible on the port side, the mystery was explained. Then, right in the track of vessels were seen monstrous mountains of ice, some of them pure white, others crossed in many directions by broad stripes of blue. Some of them were 200 feet high and 1,000 feet long. There were at least thirty of them, extending for many miles.

The sea broke against them, forcing torrents of spray up the steep acclivities of their sides. The rays of the sun had melted the upper parts of many of them into the most fanciful shapes, and imaginary likenesses of crags, cliffs, and castles could be traced in those parts more exposed to the lines of the heat. Streams of water in picturesque cascades were flowing down into the sea, and the huge, majestic masses seemed to be moving slowly to the southeast. The Helvetia passed near enough to several of them to distinguish plainly the noise of the waves as they broke against the rugged sides of the bergs. As night closed in and the moon arose the sight was indeed beautiful.

The British steamer Altmore, from Liverpool, also encountered a number of icebergs, probably the same the Helvetia met with. Her commander, Captain Watson, describes one as being a mile long and 200 feet high.

SOME EXPERIMENTS WITH SMALL BATTERIES.

BY L. BAXTER, M.D.

To illustrate the capacity and sensitiveness of the telephone, I tried a small battery made in a common tumbler with a carbon and zinc pair, and a solution of ammonium muriate as an excitant. The common sal ammoniac will answer all purposes.

This battery I included in a circuit with a Hughes microphone and a telephone; and instead of the monotonous tick ing of a watch or clock, I used a musical watch with quite a range of tone. By the use of this watch the capacity of the microphone for transmitting high or low tones with their complementary overtones may be studied and regulated.

With the battery above described I obtained all the tones clearly and well, and tried with it what effect different depths of immersion would have. One of the claims in Professor Bell's first patent on undulatory currents covers varying immersion as a means of varying the current, but I found very little difference in the operation of the telephone when the carbon plate was withdrawn so that nearly a corner touched the surface of the liquid in the battery. This led to the withdrawal of the zinc plate also, until only its corner touched the liquid. Under these circumstances the diminution in volume of sound was very slight, the tune coming out full and clear. The zinc plate being held clear of the solution a dead silence resulted, and the transition from this to full tone ensued with the slightest possible contact.

These phenomena led me to construct very minute batteries, and the progress step by step was very interesting. One arrangement of a pair shows the battery in, to me, a new light. It is this: Make up a circuit of a microphone, a telephone, and a continuous copper wire, and, of course, there is silence in the telephone. Cut the copper wire, and to one of the ends attach a bit of zinc. Bring the ends together again and silence ensues as before; but allow the hundredth of an inch clear space to intervene and bridge the gap with a drop of battery solution, and the telephone at once finds its voice, not loud, to be sure, but clear and distinct for most of the notes.

Such a "battery" as this may be even concealed in the connecting wire by being covered by the usual cotton or silk insulating covering, two or three thicknesses of tissue paper between the ends preventing metallic contact. A gun cap battery with zinc and sulphuric acid gives a strong current for the microphone circuit.

Discarding the zinc, as being too readily consumed, I have made pairs with carbon and gold, carbon and platinum, platinum and gold, etc., and in no case have I failed in getting results; but the currents are too weak for practical uses. Two pieces of carbon, even, have difference enough in their structure to determine a slight current appreciable by the telephone. The study of these combinations, though not of apparent importance, is interesting, and, where all are groping, may shed a ray of light upon something else.

Washington, D. C., June, 1880.

New Process of Simultaneous Color Printing.

Many have been the attempts so to combine the various pigments required for a polychrome print, as to reproduce them by a single impression, but the different densities and consistency of the pigments employed has hitherto found an obstacle to this desirable result. Mr. W. G. White, a member of the Society of Arts, has, after much time spent in experimenting, succeeded in forming such a combination of various chemicals with the colors he employs, as to render them, not only of uniform consistency, but also of the requisite hardness for the operations of cutting and combining to form the pattern desired. The prepared pigment chosen for the ground of the design is first run into a mould, so as to form a solid block about three inches thick. The pattern is traced with a steel point upon a sheet of artificial talc, made with a mixture of collodion and oil, and this is pressed upon the block, so as to leave an impression of the lines upon its surface. The pattern is then cut out of the block by a sharp steel knife mounted on the end of an articulated parallelogram, so as to be maintained in a vertical position, while at the same time having a perfectly free horizontal motion. The various pigments forming the design are then poured into the spaces cut out, a kind of mould being formed temporarily by a portion of the ground color, supplemented by strips of wood soaked in water. The paint is poured in hot and liquid, and, as soon as it has cooled, another is added, and so on, until the whole design is finished, thus forming a complete mosaic. In the case of a large subject, various portions of the block may be executed by different operators at once, and then joined together; the method is also being tried, with every prospect of success, of cutting out the whole pattern in wood or metal, by means of a band saw, and then forcing the die so formed into the block of ground color, so as to stamp out the color therefrom. The mosaic, or "type," as it is called, is put into a powerful press, resembling that used by lithographers, and is first shaved by a heavy steel knife, so as to render the surface perfectly flat, level, and smooth. The material to be printed upon is then laid face downward on the slightly moistened block, and a series of rollers are passed over it once or twice, when the impression is found to have completely penetrated its substance. The print is exposed for a few seconds to the heat of a hot plate, for driving off the solvents employed, and perhaps fixing the colors, which are now found to be printed so permanently that they will stand exposure to the sun, and wear only removes them in measure as the substance itself is worn away. As a crucial test, a piece of velvet printed in this manner has been boiled for eight hours in strong potash solution, when it was found that the color had not entirely disappeared. Water color drawings and oil paintings may be reproduced by this process, so as to present the appearance of chromo-lithographs and oleographs respectively. But there is a far more extended application, in printing upon textile fabrics the designs of Gobelins and Arbusson tapestry, to form curtains, *portières*, etc. The range of materials capable of being treated appears to be very extensive, as the writer saw the same design reproduced upon fine silk and the coarsest jute sacking, both impressions presenting all the necessary sharpness of outline. This process is now worked upon quite a commercial scale, and steam and hydraulic plant is being put up at Passy, Paris, to meet the demand created for cheap reproductions of artistic designs.

Lecture Experiments.

BY B. E. RIDOUT, F.C.S.*

EXPERIMENT SHOWING COHESION IN LIQUIDS.

A shallow tray, 6 inches by 2 inches, open at one end, and lipped, is supported on three leveling screws, the lipped end being slightly higher than the other. A quantity of mercury, placed in the tray, falls to the lower end, but if now a little more be added to make it flow over the lip, the cohesion is such as to enable the descending stream to drag the remainder up the inclined plane. Water gives similar results; but from the difficulty of getting a surface which will long remain unwetted, the results are not so satisfactory.

APPARATUS FOR SHOWING ELECTROLYSIS OF WATER.

A glass bottle of 30 or 40 oz. capacity is stopped with an India-rubber cork, carrying two glass tubes, which contain hermetically-sealed platinum wires, projecting an inch at the inner side, and terminating in binding screws at the other. The vessel is filled one-fifth full of acidulated water, boiled, and the stopper inserted to cause a vacuum when cold. On connecting with two "Grove" cells, the bubbles of gas so expand as to make the whole liquid appear to boil. With either a single Grove, Bunsen, bichromate, or Leclanché cell, continuous decomposition may be obtained. When sufficient gas has collected to impair the vacuum, it may be restored by boiling.

APPARATUS FOR SHOWING ABSORPTION OF HEAT ON LIQUEFACTION OF SOLIDS.

In a differential air thermometer the usual flasks are replaced by others which have had their bottoms softened, and then introverted to form a cup or basin. In this latter water is placed, and the solid then added. Any change in the liquid's temperature is at once communicated to the air space round the cup.

PRODUCTION OF A MUSICAL NOTE IN A CONTINUOUS TUBE.

In most wind instruments the sound results either from the movement of a solid body, or the air has the choice of two directions, which it alternately takes. I find, however, that it is possible to produce a good note from a tube one-quarter inch to five-eighths inch in diameter, and from six inches to a foot long, and having a part of it contracted smoothly and evenly to about a fourth of its diameter, by blowing through it. If the tube be bent upon itself at the point of contraction, the sounds are more readily obtained, though not of greater intensity.

* Papers read before Physical Society.

The Heliograph.

The London *Daily News* states that they have to thank the heliograph again for an important message received from General Stewart, and announcing the result of an attack on the British troops, in which the enemy seems to have suffered severely. The message is dated Camp Ghuzni, April 22, and was received at the India Office the following day. It is very probable that the news could not have been brought so speedily by electric telegraph. The heliograph does not require the route to be kept open. The line of communication cannot be cut, for the simple reason that the signaling takes place over the heads of the enemy, and the stations required are but few and far between. A ten inch mirror, and this is the diameter of the ordinary field heliograph, is capable of reflecting the sun's rays in the form of a bright spot, or flare, to a distance of fifty miles, the signal at this interval being recognizable without the aid of a glass. That is to say, two trained sappers, each provided with a mirror, can readily speak to one another, supposing the sun is shining, with an interval of fifty miles between them, provided their stations are sufficiently high and no rising ground intervenes to stop the rays. The adjustment of the military heliograph is a very simple matter. An army leaves its base where a heliograph station is located, and after traveling some miles desires to communicate with the stay-at-homes. A hill in the locality is chosen, and a sapper ascends with his heliograph, which is simply a stand bearing a mirror swung like the ordinary toilet looking glass, except that besides swinging horizontally it is also pivoted so as to move vertically as well. Behind the mirror, in the very center, a little of the quicksilver has been removed, so that the sapper can go behind his instrument and look through a tiny hole in it toward the station he desires to signal. Having sighted the station by adjusting the mirror, he next proceeds to set up in front of the heliograph a rod, and upon this rod is a movable stud. This stud is manipulated like the foresight of a rifle, and the sapper again, standing behind his instrument, directs the adjustment of this stud until the hole in the mirror, the stud, and the distant station are in a line. The heliograph is then ready to work, and in order to flash signals so that they may be seen at a distance, the sapper has only to take care that his mirror reflects the sunshine on the stud just in front of him.

Collodion as a Generator of Electricity.

Professor Guthrie has some time since utilized the mixture of collodion and India-rubber for this purpose, and also given it a wider scope. As regards electricity, it is very remarkable that if you rub glass with the sheet of India-rubber and collodion, negative electricity is excited, where, ordinarily speaking, positive electricity is generated. One of the applications the Professor has given to this collodio-caoutchouc is the formation of miniature balloons for experimental purposes. An ordinary glass flask is first coated inside with collodion by rolling the liquid round and round inside. When dried, a layer of India-rubber is given to the collodion in the same way, and then another layer of collodion, and so on, till four or five thicknesses of collodion are reached. When dried the film is easily detached by lifting it at the neck of the flask, and pouring between it and the glass a little acidulated water. The balloon then comes out perfectly well shaped, and ready to be filled with any gas which it may be desired to try, and the neck is well secured by waxed silk or any other suitable means. In experimental physics there seem to be many useful applications of this medium, and no doubt it will come into use.

It may be used, says the *Photographic News*, to tie down the stoppers of bottles; and here its pliability is of great service, as there is none of that disagreeableness in opening a stoppered bottle which has been tied down with ordinary bladder. Photographers have before now brought into prominence some properties of different materials whose value had not been previously recognized. What would the German army, for instance, have done without the gelatine films made insoluble by exposure to light in presence of bichromate of potash? Their everlasting sausages would have had a hard time of it.

How the Waste of the Body is Thrown Off.

At a recent meeting of the Griffith Club of Microscopy (Detroit), the fascination of microscopical study was well illustrated by the demonstrations of Prof. Chas. H. Stowell, of Michigan University. Demonstration number one was upon epithelial cells, which he produced from the side and roof of his mouth with a "poetical" movement of the tongue, and deposited upon a glass slide, to all appearance, a drop of saliva. Skimming the air bubbles from the top with a pin, and removing the surplus saliva with a piece of blotting paper, he added a drop of staining fluid to better define the cells, and placing it under a microscope exhibited a multitude of thin, transparent scales, each about one five-hundredth of an inch in diameter, and containing a nucleus in the center. This he asserted was the form in which a large part of all bodies wasted, being thrown off through perspiration constantly. Demonstration number two was of glandular epithelial cells, from the scrapings of the liver of an ox, much smaller, but similar in some respects to those previously shown. Demonstration number three was of cells from the mucous membrane of the roof of a frog's mouth, which exhibited the extraordinary action of the cilia. These cells were fringed with hair-like protuberances, styled cilia, that moved with great activity and regularity, and seemed endowed with separate organic life and intelligence. The professor asserted that these cells were very common in the human body, noticeably in the bronchial tubes, where the cilia, moving always in one direction, were active in throwing off foreign substances injurious to health. Demonstration number four was of the circulation of blood in the feet of several frogs, rendered insensible by an injection of woorara.

One of the most noticeable features of the evening was the exhibition and use of twenty Ann Arbor frogs, which the professor brought with him as scientific curiosities, stating that they were a distinct variety peculiar to Ann Arbor, and of great rarity, possessing a most curious and interesting resemblance to the human body in one or two respects. Apologizing to the ladies present for so doing, the professor gathered the thirty gentlemen present at one side of the room and exhibited the distinguishing characteristics to them.

The Chulafinne Meteorite.

The analysis of the Chulafinne, Alabama, meteorite, described in our issue for May 6 last, shows the following elements:

Iron	91·[illegible]
Nickel	7·[illegible]
Cobalt	0·[illegible]
Phosphorus	0·170
	99·646

This analysis, made by J. B. Mackintosh, E.M., of the Columbia College School of Mines, is furnished by Mr. W. E. Hidden.

The Millers' Exhibition.

Most gratifying reports are given with regard to the character, attendance, and promise of the Millers' International Exhibition, which was opened in Cincinnati, Ohio, May 31. In the variety and value of its exhibits it fully justifies the large expectations of its friends and promoters, and there is every reason to anticipate great national benefits to flow from it. The Exhibition will continue through June.

AMATEUR MECHANICS.

GLASS ENGRAVING.

One of the simplest and easiest operations possible with a foot lathe is that of glass engraving. The tools—aside from the lathe, which every amateur is supposed to possess—are simple and inexpensive, and only a little practice is required to attain a fair efficiency in the art. Any foot lathe will do if it is provided with a drill chuck. The copper disks used in engraving may be readily adapted to the lathe by fitting a spindle to the drill chuck, and attaching the copper disk or wheel to the spindle by means of an ordinary machine screw tapped into the end of the spindle. It is best to have a spindle for each copper disk or wheel, although it is not absolutely necessary except in the case of the very smallest.

The amateur should supply himself with at least a dozen wheels of different diameters and thicknesses. Some of them should be from two and a half to three inches in diameter, and from one thirty-second to one eighth inch thick; others one inch in diameter and from one thirty-second to one quarter inch thick; also several about one half inch in diameter and of different thicknesses. He should also have some very small ones, say from one eighth to one quarter inch in diameter, and from one sixty-fourth to one quarter inch thick. The very small wheels are best formed on the end of a soft iron rod fitted to the drill chuck. Some of the wheels may be convex on the edge, some beveled, and some of them may be straight across or cylindrical. Pieces of copper tube of different sizes and thicknesses are also very useful in cutting circles in some kinds of work.

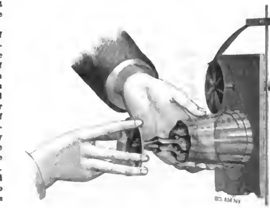


Fig. 1.—GLASS ENGRAVING, LINING.

The engraving shows a polishing lathe head in use for this purpose, but any lathe having sufficient space between the spindle and the bed will do, and if this space is insufficient the lathe head may, in most cases, be raised upon blocks to give all the space required.

A rod extending upward from the lathe bed supports a thio metal strip that rests oo the top of the wheel and prevents the abraiding material from flying in the face of the operator.

The first lesson for the amateur will be that of engraving either thin or wide lines around a goblet or other vessel, or along the edges of a pane of window glass. The method of arranging the lathe and holding the work is so clearly shown in Fig. 1 as to scarcely require a word of explanation. A wooden gauge is placed behind the cutting wheel to gauge the distance of the line from the edge of the vessel. This being done, a little washed flour emery, mixed with olive oil is applied to the periphery of the wheel, the latter being revolved at a moderate speed. Now, by pressing the goblet against the gauge, and at the same time holding it lightly against the wheel and turning it slowly, a line will be formed around the goblet. As soon as the wheel ceases to cut well it should be again supplied with emery and oil. A few lines of this kind along the edges of a pane of glass give it an elegant appearance. The only necessary precaution is to have the edges of the glass perfectly straight and smooth. If it is otherwise, a piece of wood having a slit sawed in it for receiving the edge of the glass may be put on the edge of the glass temporarily to guide it.

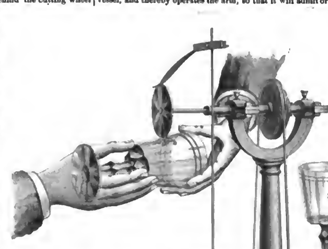


Fig. 2.—GLASS ENGRAVING, LETTERING.

The operation of cutting letters, vines, and other ornamental work is somewhat difficult at first, but with practice it soon becomes easy. The design is first drawn with a mixture of gum water and whiting, by means of a pen or small brush; the lines are then followed by the appropriate wheel charged with emery flour and oil. The matter of choosing the proper wheel for a certain kind of work must be left entirely to the operator, and he must get the most of his knowledge by practice if he has no opportunities for observation.

The smaller wheels will naturally be used for small work and for short curved lines, while the larger wheels will be used in making large curves and straight lines. Should it be desirable to polish the engraved work the operator will use lead wheels, applying pumice stone and oil.

Gems are engraved in much the same way as glass, the difference being that iron wheels and diamond dust are used instead of copper wheels and emery. The lathe should be fine and the tools very small. The polishing will be done with putty powder or rottenstone and oil. M.

MISCELLANEOUS INVENTIONS.

Mr. Orlo H. Drinkwater, of Cedar Point, Kan., has patented an improved grain car door fastening, which consists of a quickly adjustable fastening formed of a horizontal arm jointed in the jamb of the car door about the level of the top of the door when the latter is down, which arm is provided with a vertical screw tapped through a hole in the extremity of the arm and carrying below a foot which rests upon the top of the car door. When the screw is tightened clamps the door tightly down to its place, the arm being capable of being swung into the plane of the doo when the latter is to be fastened, or turned outwardly at right angles when the door is to be opened.

Mr. Theodore Nuthmann, of Brooklyn, N.Y., has patented an improved spring-soled boot and shoe. The object of this invention is to furnish spring soled boots and shoes, so constructed as to give the spring more freedom of movement, give more elasticity to the boot or shoe, better support the foot, and prevent the sole from spreading, as it is liable to do when the spring is inserted in the usual way.

Mr. William A. Warren, of Princeton, Ill., has patented a valve for water pipes for supplying a constant and self-regulating flow of water in troughs that are designed for watering stock. The invention consists essentially of a long arm hinged to the end of the water supply pipe, and having its free end connected to a float that rises and falls with the rise or subsidence of the water in the containing vessel, and thereby operates the arm, so that it will admit or cut off the flow of water through the supply pipe, the opposite faces or ends of the said supply pipe and arm being cut obliquely for the better working of the valve or arm within a limited space.

Mr. Enos Peters, of Appleton, Ohio, has patented a harness clamp so constructed as to clamp tugs and other long straps of harness for their whole length, and hold them securely while being stitched, trimmed, and dressed.

Mr. Emile F. Pernot, of Bowling Green, Ohio, has patented a device adapted especially for printing addresses. The invention consists of a galley or form of type made to slide intermittently in a box or case beneath a transverse slot in the cover of the said case by the action of a lever and pawl, while the same motion of the lever causes a plunger to press a strip of paper through the slot in the top of the box upon the type beneath it.

Mr. John A. Carter, of Rose Bud, Ill., has patented an improvement in the class of musical instruments wherein hammers are employed to strike upon wires or other resonant bodies arranged in any usual manner, and the movement of he hammers obtained by a perforated music sheet that is fed by a crank.

Mr. Samuel M. Wright, P. O. Box 489, Rochester, Fulton county, Ind., has recently patented an improved rein holder arranged for convenient attachmeot to any dashboard, and it is made adjustable as to height.

Mr. Samuel Herzberg, of Pontiac, Ill., has lately patented an improved tag or ticket holder which is very simple in its construction and well adapted to the purpose for which it is intended.

Mr. Lewis Morse, of North Attleborough, Mass., has patented an improvement in connecting the shank of the button with the top; and the object of the improvement is to facilitate the application of the button to the cuff or other object and the fastening of the two parts thereof together. The invention consists in a button made in two parts and provided with a single wire spring having its ends sheathed in opposite tubes, of which one is movable and the other rigid, opposite bends of the wire beiog carried under the rim of the button.

Bertha Schleifer, of New York city, has patented an improved hook and eye fastener. This invention consists in securing hooks and eyes to strips of fabric (designed to be attached to a dress waist) by means of clasps or clamps.

Mr. Thomas L. Clacher, of New York city, has patented an improved box for containing pamphlets, magazines, manuscripts, and the like articles.

An improved harvester reel, patented by Mr. William H. Akens, of Penn Line, Pa., is provided with a simple and convenient device for gathering cut grain into gavels. The invention consists of a circular plate fixed upon one of the standards and having a journal of the axle passing centrally through it, and having fixed on its inner face two segmental cams, with which the D-shaped pieces engage as the device is revolved, and thereby cause the rakes to move on their hinges, as is desired.

Mr. Michel Sichel, of Cape Girardeau, Mo., has patented an improved fire escape ladder which consists of an adjustable windlass, by which the ladder may be extended and the suspended platform be elevated and lowered.

Mr. Lewis Morse, of North Attleborough, Mass., has patented an improved method of uniting glass and enamel to metal. The object of this invention is to provide a cheap and simple method whereby, in the manufacture of buttons, studs, and other ornamental articles of jewelry and dress that consist partly of glass, enamel, or cement, the glass, enamel, or cement portions may be readily and firmly united to the metallic parts.

Mr. Albert S. Robinson, of Albany, N.Y., has patented a heel stiffener and counter support. This is a metallic device applicable to any boot or shoe heel for stiffening the heel and supporting the counter, and it consists in a plate formed with a flat head for bearing on the counter, a flange at the opposite end to rest beneath the heel, and a tongue intermediate of the ends, for entering the upper portioo of the heel. The device is secured by a screw passed upward through the bottom flange and through the tongue, so that the heel is clamped between the flange and tongue.

Mr. Richard Himes, of Elizaville, Ky., has invented an improved bee hive. It is so constructed that the surplus honey can be easily and conveniently removed without disturbing or exciting the bees. It will allow the swarming of the bees to be controlled, and it can be easily arranged to form a warm and dry wintering hive.

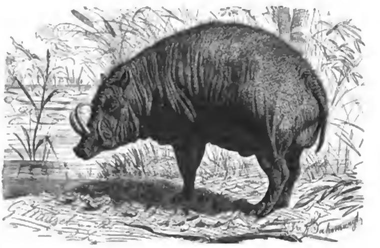
An improved combined cotton scraper and chopper has been patented by Mr. Lorenzo D. Bowman, of Beebe Station, Ark. The object of this inventioo is to furnish combined cotton scrapers and choppers so constructed that the operating implements will be fully under the control of the driver, and may be adjusted to work at any desired depth in the ground.

THE BABYROUSSA OF MALACCA.

This strange creature is notable for the curious manner in which the tusks are arranged, four of these weapons being seen to project above the snout. The tusks of the lower jaw project upward on each side of the upper, as is the case with the ordinary boar of Europe, but those of the upper jaw are directed in a very strange manner. Their sockets, instead of pointing downwards, are curved upwards, so that the tooth, in filling the curvatures of the socket, passes through a hole in the upper lip, and curls boldly over the face. The curve, as well as the comparative size of these weapons, is extremely variable, and is seldom precisely the same in any two individuals. The upper tusks do not seem to be employed as offensive weapons; indeed, in many instances they would be quite useless for such a purpose, as they are so strongly curved that their points nearly reach the skin of the forehead. The female is devoid of these curious appendages.

From all accounts, the babyroussa seems to be a very fierce and dangerous animal, being possessed of great strength, and able to inflict terrible wounds with the tusks of the lower jaw. A naval officer who had experienced several encounters with this creature, spoke of it with great respect, and seemed to hold its warlike abilities in some awe. The adult male babyroussa is considerably larger than the boar of England, and the officer above mentioned told me that he had seen them as large as donkeys. It is a very good swimmer, and will take to the water for its own gratification, swimming considerable distances without any apparent effort.

The skin of the babyroussa is rather smooth, being sparsely covered with short, bristly hairs. The object of the upper tusks is at present unknown, although certain old writers asserted that the animal was accustomed to suspend himself to branches by means of the appendage. The babyroussa lives in herds of considerable size, and is found inhabiting the marshy parts of its native land.



THE BABYROUSSA.—(*Babirussa Alfurus.*)

THE BARBASTELLE.

The barbastelle does not seem to be very plentiful in this country, nor in England. One of these animals, which was for some weeks in possession of Mr. Bell, was taken in Kent, says Wood's *Natural History*, at the bottom of a mine seventy feet in depth. It did not seem to be so active as some long-eared and other bats which were taken in the same locality, and preferred lying on the hearth rug to using its wings. It fed readily on meat and would drink water, but never became so tame as its companions. Its captive life lasted only a few weeks, its death being apparently hastened by the attacks of the other bats, one of which was detected in the very act of inflicting a bite on the barbastelle's neck.

The color of the barbastelle is extremely dark, so much so, indeed, that by depth of tint alone it can be distinguished from any other British bat. On the hinder quarters, a rusty brown takes the place of the brownish-black hue which characterizes the fore part of the body. Underneath the hair is nearly gray, being, however, much darker towards the neck. The length of its head and body is just two inches, that of the ears half an inch, and the expanse of wing measures between ten and eleven inches. The ears are tolerably large, and slightly wrinkled. The tragus is sharply pointed at its tip, and widened at its base. A full view of the face shows a rather deep notch in the outer margin and near the base of the ear.

BARBASTELLE.—(*Synotus Barbastelle.*)

Successful Importation of Soles.

The first English soles ever brought alive to this country arrived by the Black Ball packet ship Hamilton Fish, May 21. Captain Mortimer started with twenty-five fish placed in a tank specially constructed so that the lurching of the vessel would not be felt by the fish, the sole, owing to its extreme delicacy, being killed by the least shock. During the voyage the tank was aerated every four hours, and deep sea water was given to the fish. Notwithstanding these precautions nineteen died. The rest came safe and in fine condition. Two were females with spawn. They were planted on the government reservation, just inside Sandy Hook. The sole is a flat fish, of delicious flavor, peculiar to British waters. Many attempts have been made before to introduce it into American waters, but without success.

Novel Mode of Killing Gophers.

In this paper some six months ago there appeared an illustration and description of a novel mode of destroying gophers, moles, etc., by injecting poisoned fumes into their holes and runs. It seems, from the San Francisco *Chronicle*, that the apparatus has been recently tried in that city, and the writer gives the following account of it.

At the Laurel Hill Cemetery, yesterday morning, the agent for a new squirrel, ant, and mole exterminator, gave a test of his apparatus. The machine consists of a furnace constructed of galvanized iron, lined with fire clay, about 12 x 24 inches in size. On the inside of this furnace is a discharge pipe, passing from near the top down through the bottom. To this furnace is attached an air pump by means of sectional tubes and elastic hose, which can be instantly adjusted for operation. A fire having been made in the furnace, and a poisonous compound dropped in, the top is securely closed, the chamber placed over the gopher or squirrel hole, and the air forcing machine started, when all the smoke and poisonous vapors are forced down into the hole, killing, it is claimed, everything animate with which it comes in contact. During the experiments at the cemetery yesterday sulphur was used, being dropped in the furnace in half-pound packages. When the apparatus was put in operation over one of these gopher holes, the ground for a radius of several yards seemed animated by a series of miniature volcanoes, the sulphuric vapors belching forth from numerous undiscovered holes. About ten minutes' pumping serves to thoroughly impregnate the burrow and its connecting drifts with the poisonous fumes, and, it is presumed, to totally annihilate its inhabitants.

Rose Slugs.

The rose slug, like most other insects, has a large number of natural enemies, but these are not yet adequate to the task of keeping it in check. The attention of florists has, therefore, been largely directed to the discovery of some reliable artificial remedy.

Various applications have been tried with more or less success, among which the most certain in its effects is whale oil soap suds, made in the proportions of one pound of the soap to eight gallons of water. The objections to this remedy are that it has a disagreeable odor, and is liable to discolor the opening buds. Dusting freely with powdered white hellebore has also been tried with very good success, and it may be used in water by dissolving a tablespoonful of the powder in two gallons of boiling water. The pyrethrum powders have as yet been used only to a limited extent, but with the prospect that thoroughly applied they would prove effectual. Lime has long been used with satisfactory results, especially if applied when the dew is on the plants.

Capt. E. H. Beebe, of Galena, Ill., wrote some time since to the *Gardeners' Monthly* that he had found powdered sulphur, applied when the leaves were wet, certain destruction, and Miss E. A. Smith corroborates his experience (*Prairie Farmer*, May 4, 1878). Wood ashes were strongly recommended in the *Country Gentleman* for June 18, 1871. The Paris green mixture has been used with excellent results on bushes where it was not desired to cut or pluck the flowers, but in view of the other available means of destruction is not to be recommended. All applications should be made just at night, as they are then more certain of coming in contact with the insects. Something can also be done to prevent the flies from maturing. As the cocoon in which the larva hibernates is very frail, and as the latter does not survive the rupture of the same, it follows that many of the insects may be killed by thoroughly stirring and pulverizing the soil of rose beds. Roses that are transplanted from one locality to another should, before setting, be immersed in a tub of water and have every particle of soil washed from their roots. By observing this precaution newly made gardens may be secured for a long time against this worst enemy of the fairest flower.—*American Entomologist.*

The Grapevine Flea Beetle.

Professor Comstock, the entomologist of the United States Department of Agriculture, gives the following method of fighting an insect which has lately been a great pest in Canadian vineyards. The grapevine flea beetle (*Haltica chalybea*, Illiger) has been one of the most formidable enemies that the grape growers of this country have had to contend with. The only redeeming feature about it is that it seldom appears in the same locality in great numbers during consecutive years. These beetles leave their hibernating quarters in April, and attack and destroy the young leaf buds as soon as they appear; later they feed upon the leaves which have escaped their earlier ravages, and deposit their eggs upon them. The eggs are of an orange color, and soon hatch into small chestnut-colored larvæ. These larvæ also feed upon the leaves, and when they appear in great numbers sometimes strip the vines of their foliage. After a month of active life the larvæ descend to the ground and bury themselves near the surface, where they make cells of the earth, and change to pupæ of a dirty yellow color. The adult beetles, issuing in the course of a few weeks, again feed upon the leaves during the autumn, doing, however, but little damage, and later seek their winter quarters beneath the bark and splinters on the vines and the stakes which support them, as well as under any rubbish that may be in the vineyard. This week specimens of this insect were brought me by Mr. A. R. Phillips, of this city, with the statement that his vineyard in Virginia is infested with them to a perilous extent. I at once sent Mr. L. O. Howard, my first assistant, in company with two others, to the vineyard in question, for the purpose of experimenting with remedies.

Mr. Howard's report was very gratifying. Finding it impracticable to jar them from the vines into sheets or other receptacles, and keep them there, he hit upon the plan of drenching the sheets with kerosene; this worked in a most satisfactory manner. The mode of procedure is as follows: Take two pieces of common cotton sheeting, each being two yards long and half as wide; fasten sticks across the ends of each piece to keep the cloth open, and then drench with kerosene. Give the sheets thus prepared to two persons, each having hold of the rods at opposite ends of the sheets. Then let these persons pass one sheet on either side of the vine, being careful to unite the cloth around the base of the vine; then let a third person give the stake to which the vine is attached a sharp blow with a heavy stick. Such a blow will in nearly every case jar the beetles into the sheets, where the kerosene kills them almost instantly.

This process, after a little experience, can be performed almost as rapidly as the persons employed can walk from one vine to another. The expense necessary is very trifling, and boys can do the work quite as well as men. Warm bright afternoons are the proper times for this work to be done, and it should be performed faithfully every sunny day until the vines are out of danger. This mode of combating the beetle promises to be much more effectual than any other which has been hitherto suggested; for it can be used early in the season before the vines are seriously injured and before the insects have begun to multiply. In connection with the above, the remedies which have been recommended often should, if necessary, be used. These are as follows: First, all rubbish should be removed from the vineyard, and the stakes and trellises which support the vines be well cleaned of bark and splinters, so as to afford the beetles little chance for hibernating in the vineyard. Second, if the larvæ appear in great numbers, lime should be sifted over the vines.

Protection Against Mosquitoes and Flies.

Quassia water is, according to a correspondent of *Nature*, a protection to peach trees against insect blight. The first year the trees bore well and the new wood was elbow length or more. I next tried quassia in the vinery. Instead of lime washing the walls to get rid of the green fly, one watering with quassia dismissed them in a day. My head gardener, who had previously much experience in nursery grounds, wondered that he had never heard of it before. He now uses it in all cases as a protection from flies and blight. The dilution goes a long way; one pound of chips of quassia wood boiled and reboiled in other water until he has eight gallons of the extract for his garden engine. He finds it inadvisable to use it stronger for some plants. This boiling makes the quassia adhesive, and being principally applied to the underleaf, because most blight settles there, it is not readily washed off by rain. Quassia is used in medicine as a powerful tonic, and the chips are sold by chemists at from sixpence to a shilling a pound. The tree is indigenous to the West Indies and to South America.

And now as to gnats and mosquitoes. A young friend of mine, severely bitten by mosquitoes and unwilling to be seen so disfigured, sent for quassia chips and had boiling water poured upon them. At night, after washing, she dipped her hands into the quassia water and left it to dry on her face. This was a perfect protection, and continued to be so whenever applied.

At the approach of winter, when flies and gnats get into houses and sometimes bite venomously, a grandchild of mine, eighteen months old, was thus attacked. I gave the nurse some of my weak solution of quassia to be left to dry on his face, and he was not bitten again. It is innocuous to children, and it may be a protection also against bed insects, which I have not had the opportunity of trying. When the solution of quassia is strong it is well known to be an active fly poison, and is mixed with sugar to attract flies, but this is not strong enough to kill at once.

ENGINEERING INVENTIONS.

Mr. Richard B. Ireland, of Trenton, N. J., has recently patented an improved railway signal, in which the sliding night signals carry corresponding day signal arms or banners of different configurations and color, the danger slide being elevated by raising either of the other slides (caution or safety), their normal condition being, of course, danger.

Mr. John R. Jones, of Clarkesville, Iowa, has recently patented an ingenious and effective device for operating car brakes. It may be operated either by hand or by means of a friction wheel fitted on the locomotive. It gives a simultaneous movement to all of the brakes on the train.

Mr. Eugene H. Angamar, of New Orleans, La., has invented a boiler adapted for application to horse cars now in use, so as to utilize such horse cars without material changes. The invention consists in a boiler made in two portions, separated by a mediate chamber, the water and steam spaces of the parts being connected by pipes.

An improved slate dressing machine, patented by Mr. Francis Shenton, of Slatington, Pa., consists of angularly set vertically moving knives for beveling and trimming the end edges of the slates, and, in connection therewith, grooves and ways and other devices for holding the slate in its proper position for the action of the knives, and an arrangement for holding the knives in position to act upon the edges at the proper moment.

The Army Worm on Long Island.—The army worm has appeared in great numbers at Islip, Long Island, and is naturally creating much alarm among the farmers.

ROOFED COUNTRY ROADS.

To a large extent in the South and Southwest the highways are of two distinct sorts—in local parlance, *turnpikes* and *mud roads*.

The former title covers the main State roads, often constructed with great care and cost, and usually macadamized. The latter includes the great majority of country roads; and for nine months or more every year the name is exactly descriptive of their character. They are emphatically mud roads, and the mud is deep and tenacious.

Plank roads are sometimes tried where lumber is cheap; but they rest under the disadvantage of being expensive, and they are neither durable nor easily kept in repair. Accordingly mud roads predominate, and the communities possessing them are little given to social or commercial intercourse with their neighbors save during the brief periods when the mud is dry and the wheeling passably good.

An exception to this rule appears in Bosier Parish, Louisiana, where an attempt has been made to keep an important earth road dry and usable by the novel device of roofing it, so as to keep off the rain. The first stretch of covered road on this plan runs from Red Chute Bridge, Louisiana, four miles across Red River bottom, near Shrieveport. The idea originated with Judge J. D. Watkins, of Shrieveport, and, as is the usual fate of new ideas, it aroused no little popular ridicule. Judge Watkins was not a man to be laughed down. Obtaining a State charter for his enterprise he began to build the road. His opponents complained that he was obstructing the parish road, and attempted to stop the work; but ample and lawful room having been given for the parish road their opposition came to nothing. It is now four years since the work was begun, and Mr. John S. Williams, of Shrieveport, who has been connected with the enterprise from the beginning, informs us that the road is a complete success. At the time of his writing, in March, while the uncovered roads were axle deep in many places with stiff mud, the shed road was firm and dry.

In building the road, the bed, 18 feet wide, was thrown up just enough to keep out the surface water; and over it was put a roof of plank five-eighths inch thick, the planks being 12 inches wide and 20 feet long. Cypress from the neighboring swamp is used for posts, and roughly sawed timber for frame work. By means of an ingenious platform mounted on a common two-horse wagon and supporting a light framework, four men easily put up 20 sections, of 20 feet each, a day. The cost of the road was about $1,500 a mile, with lumber at $1 a hundred feet, labor $1 a day, posts 12½ cents each, earthwork 20 cents a cubic yard, and nails 5 cents a pound. The advantages of the road arise from its cheapness, as compared with any other style of road possible there, its durability, and its unvarying serviceableness. The native clay soil, when kept dry, makes a better roadbed than either wood or stone, and the road is easily kept in repair. The wagons do not touch the woodwork, and the roof will last five times as long as planks laid upon the damp earth. Though the sides are not enclosed the rain does not drive in enough to make the roadbed muddy, much less wash it. In short the practical test of the road, on the score of cheapness and efficiency, has been so satisfactory that the ridicule and opposition it first awakened have been overcome, and other roads on the same plan are about to be constructed.

Germination of Cotton and other Seeds.

In the opinion of General Le Duc a discovery of value has been made in relation to the planting of cotton. A question having arisen as to the situation of the oil cells in Indian corn, the matter was referred to the microscopist, Prof. Thomas Taylor. He found a series of oil cells near the outer surface, and another row immediately surrounding the chit or germinating point, evidencing the complete protection which the latter received. This fact led Prof. Taylor to experiment, with a view to ascertaining the amount of resistance offered to the attacks of agents generally supposed to be of a destructive nature to all organic life, cotton seed being used in the experiments. For the purpose of removing the cotton from the seed he used concentrated sulphuric acid, which completely removes it without visibly affecting the outer brown shell of the seed.

To test the actual effect on the germinating property he handed some cotton seed thus treated and afterward washed, to Mr. Saunders, who planted it. To the surprise of every one except Mr. Taylor, who had foreseen this result if the germ had not been destroyed, the seed came up at least five days earlier than that in its natural state. To ascertain whether this might not be owing to the soaking the seed received, some was kept for several months and then planted at the same time with seed of the same crop unprepared. The same results followed.

The advantage to planters in having five or six days start can scarcely be overestimated, whether availed of in avoiding early frosts or raising early cotton, for which premiums are offered by several cotton boards in the South. But this is not said to be the principal benefit conferred by the discovery. Hitherto cotton planting has had to be done by hand, and the seed sown broadcast, owing to the adherent cotton preventing the seed being used in the planters used for corn and other clean seed. After preparation the seed can be used in any planter, and, by the regularity of growth resulting, the subsequent cultivation greatly facilitated. The mode of preparing the seed is as follows: The seed is placed in an earthen or glass vessel and ordinary sulphuric acid poured over so as to completely cover it. It is then stirred until the brown shell is left free from cotton. The acid is poured off to be used again, and the seed washed till all acidity disappears from the water, and dried. A large quantity is to be thus prepared and distributed among cotton planters for next season. The acid, after it has become saturated or exhausted, is to be experimented with to ascertain whether the glucose cannot be recovered. Experiments are also to be instituted with a view to ascertain the practicability of the process as applied to seeds slow of germination, such as that of the palm, which takes three years to sprout.

Sugar by Diastase.

It is a curious fact that as diastase, or whatever other substance may be the transforming agent in malt, acts upon starch and converts it into maltose and dextrose, so these products in their turn exert a retarding influence upon further change. The presence of a large proportion of dextrose or maltose undoubtedly stops the transformation of starch, and this fact has been recorded by Schutzenberger and others who have studied the question. It is easy to understand, therefore, that in a very thick mash there may be an incomplete conversion; but if a portion of the dextrose or maltose be removed, and a little fresh diastase added, the action will be continued. This is, to some extent, practically done in the sparging operation in the brewery, but in consequence of the high temperatures usually employed most of the diastase is destroyed. It would appear, therefore, that beneficial results would be obtained by reserving a little of the grist for the purpose of sprinkling it over the malt just prior to sparging; this fresh malt would yield the necessary diastase or converting agent required to transform any unconverted starch or dextrine into sugar. It may be argued that there will be loss, in consequence of the last addition of malt not being completely extracted, but this might be obviated by making a small separate mash of it at a comparatively low temperature.—*Brewers' Guardian.*

Land Birds at Sea.

During a recent passage of the White Star steamer Germanic from Liverpool to New York, and when about one thousand miles from Queenstown, a strange bird was discovered in the rigging. The sailors and passengers endeavored to catch it, but without success, until Dr. C. W. Goff, of this city, one of the passengers, came on deck, when the bird at once flew into his hands. The doctor cared for it, and upon the arrival of the steamer presented the bird to the collection at the Central Park. The bird is known as the whimbrel—a peculiar land bird resembling the curlew in habits and about the size of a prairie hen, black and gray plumage, wings like a bat, with a long whalebone-like bill in shape similar to that of a woodcock. Great interest was attached to the bird by the officers of the ship from the fact of its being a land bird found so far at sea, with wings but poorly calculated to sustain it for any length of time.

The owl "Kate Field," captured under similar circumstances in mid-ocean last autumn by one of the crew of the White Star steamer Celtic, is still at the Central Park, thriving, contented, and doing honor by the wisdom of her countenance to the name she bears.

Coin in the Sub-Treasury.

The law requiring the coinage of $2,000,000 a month in silver dollars, in connection with the public aversion to handling large sums in silver when bills can be obtained, has resulted in making a serious plethora of coin in all our government depositories. Those at San Francisco, Cincinnati, and Chicago were all filled early in March, and those at Washington, Boston, Philadelphia, and St. Louis reached the limits of their capacity soon after. As a consequence nearly all the newly coined silver is being piled up in the Sub-Treasury in this city. This inconvenient treasure, weighing over 612 tons, is stored in a huge vault, 47 feet long, 27 feet wide, and 12 feet high. In the same vault are stored 130½ tons of gold, worth over $65,000,000.

Burnt Alum.

Ordinary alum is a double sulphate of potash and alumina, containing, when crystallized, twenty-four molecules of water. When heated, it melts in its water of crystallization, and on continued heating this is expelled, leaving a dry powder, known in pharmacy as *Alumen usta*, or burnt alum. That sold at the drug stores is often imperfectly dried, and should be placed for an hour or more in a hot bake oven before use. According to C. Bernbeck the best test for a good article is, that it is nearly tasteless when put on the tongue, and takes twelve to twenty-four hours to dissolve in water. Much of the alum now in commerce contains no potash, the alkali being ammonia. Of course ammonia alum cannot be converted into burnt alum, as the ammonia is expelled at the same time, leaving only sulphate of alumina behind.

Memphis Reclaimed.

It is reported that Memphis is at last clean, and so far worthy of exemption from further epidemics of yellow fever. Twenty miles of sewer pipes have been laid already, and over 700 men are now at work for the district government. Thirty miles of sewers will be finished by June 1. This will nearly complete the sewer system. In addition, an equal number of miles of drain tile have been laid. Aside from sewerage and drainage, mention must be made of the cleaning and filling of vaults, the demolition of hundreds of old buildings, the tearing up of the Nicolson pavement, the cleaning up of cellars, and the general renovation of stores and dwellings.

Pressure in Heavy Guns.

The powder question in all its aspects is just now a matter of peculiar importance, as affecting our monster ordnance. In saying this we refer not only to the size and quality of the so-called grains, but likewise to the construction of the cartridge and the mode of firing it. In the ramming of the cartridge a very safe powder may be transformed into a very dangerous one, by the crushing of the cubes or prisms, so as to convert large grain powder into small grain. The last round fired from the rent gun on board the Duilio was subject to this peril, if we may accept the statement that the cartridge stuck in the chase and had to be rammed home with unusual force. But this is not all. When a cartridge is fired from an axial vent in the gun, it is just possible that ignition may commence at the rear of the charge, despite those internal arrangements which are intended to secure a different result. It is well known that when a long cartridge is ignited at either extremity, particularly the rear, wave pressures are set up, far exceeding the normal force of the powder, and acting locally with great violence. The term "pressure" is perhaps hardly applicable to the force thus exercised, its character being obviously dynamic, the powder chamber being subjected to actual blows occasioned by the dashing to and fro of the gases, and probably of the liquid product of combustion also.

What this force really amounts to is instructively shown by some experiments carried out at Woolwich with one of Mr. Vavasseur's steel guns, weighing 16 tons, and having a caliber of 10 inches. The projectile in each instance weighed 400 pounds. A charge of 70 pounds of service pebble powder was made up, with a cartridge 25 inches long, and the point of ignition was at the center of the charge. Under these circumstances the crusher gauge at the rear end of the charge showed a pressure of 21 tons on the square inch, and at the base of the shot 18 tons, the initial velocity of the shot being 1,412 feet per second. In the next round everything was the same, except that the powder was fired at the rear end of the charge. The pressure at that spot rose to 45·1 tons per square inch, and at the base of the shot it became 50·1 tons. Despite this enormous pressure the velocity of the projectile was only slightly raised, becoming 1,436 feet per second. With 75 pounds of powder fired in the same manner, the cartridge being 26 inches long, the pressure was practically the same as before at the rear end of the charge, but rose to 59 tons per square inch at the base of the shot. The initial velocity then became 1,497 feet per second.

In the next round the charge consisted of 80 pounds of service pebble, the cartridge being 27½ inches long. The point of ignition was continued at the rear, and the pressure at that spot became 57·6 tons per square inch, rising to 63·2 tons at the base of the shot, the initial velocity being 1,541 feet per second. A charge of 80 pounds of 1½ inch cubical powder was then fired in the same manner, the rear pressure being 25·1 tons, the forward pressure 24·8 tons, and the initial velocity 1,482 feet. Finally a charge of 88 pounds of 1½ inch powder was fired from the rear end, the pressure at the rear of the charge becoming 36·4 tons per square inch, and at the base of the shot 24·1 tons, the projectile having an initial velocity of 1,514 feet per second. We may add that there was one other round, in which the charge consisted of 70 pounds of service pebble powder, the ignition being at the rear, when the pressure at the rear end of the charge was 45 tons per square inch, and at the base of the shot 37·5 tons, the initial velocity being 1,455 feet.

The results thus obtained are peculiarly interesting at the present time, and it may be allowed that the gun was a strong one which withstood such abnormal pressures. It is obviously a matter of especial importance, where an axial vent is used, that proper means should be taken to secure the ignition of the charge at the right point. The violent ramming of a cartridge might perhaps damage its internal structure so as to bring about ignition at the rear instead of the center, with the certain result of abnormal pressures at particular spots, especially in the fore part of the powder chamber.—*The Engineer.*

American Locomotives for Japan.

The Japanese Government is completing the Poronai Railway connecting the City of Hokkaido with adjacent towns. Col. Jos. N. Crawford, an American engineer, is in charge, and has recently had shipped a pair of narrow gauge (42 inches) locomotive engines to that country. They were built by H. K. Porter, of Pittsburg, Pa., and are named the "Yoshitsune" and the "Benkei," after noted characters in ancient Japanese history. In accordance with suggestions, these engines possess peculiar features as to stacks, ash pans, and spark arresters, from the fact that the line passes through the most inflammable class of property.

The engines are of the "Mogul" pattern, with six drivers of 36 inches diameter; cylinders, 12 x 16 inches; weight, ready for service, 18 tons. The same firm have just completed an engine of novel proportions for shipment to the works of the Longfellow Mining Company of Arizona. The gauge in this engine is only 20 inches; cylinders, 6 x 10 inches; four drivers of 22 inches diameter supporting the engine, which is a compact business-like looking affair, weighing 4½ tons, and planned to overcome a gradient of 100 feet to the mile. The Longfellow Works are a New York enterprise, this little engine being ordered by J. Freudenthal of this city. After being taken apart and boxed, the "Coronado" was shipped to Los Vegos, N. M., thence to the mines by wagon.

Railway Improvements Wanted.

In offering prizes for the period of six years ending with July 15, 1881, the German Railroad Union suggests the following as especially desirable: (1) The invention of a locomotive, tender, or car wheel of simple but safe design by which the loosening of tires will be effectively prevented. (2) The invention of a simple apparatus, which can be depended upon under all circumstances, which will render it possible for trainmen on different parts of a long train to communicate with the engineman. (3) The invention of a cheap but reliable signal apparatus for the automatic blocking of trains which follow each other closely upon the open road, for regulating and rendering safe the traffic on crowded sections of road. (4) The invention of an apparatus which will make it possible for a trainman with the ordinary form of brake to apply the brakes simultaneously on two adjacent cars. This is required especially for freight cars. (5) Plans for improved statistics of the distribution and movement of cars, having regard to the administrative requirements of the separate roads, the settlement of the accounts for interchanged cars, and general statistical purposes. (6) The preparation of an exhaustive commentary on the working regulations, with special reference to the decisions of recent years. (7) A treatise based on statistical investigations of the influence and desirability of the present usual division of passengers and arrangement of cars into three or four classes, from a general standpoint as well as with regard to the profit to the roads. (8) A short abridged encyclopedia of the technics of railroads, in the sense of genuine encyclopedia, that is, a systematic grouping of the materials and their relation to each. (9) A history of the development of freight tariffs and their influence on the public welfare.

A Steep Railway.

A letter from Naples, written by one of the nine persons who made the experimental trip on the new railway to the crater of Vesuvius, gives some particulars of the line and the journey. The actual railroad is 800 meters long and terminates 200 meters short of the mouth of the crater. The inclines are tremendous: 4 in 10 for the first 135 meters; 63 in 100 for the next 330 meters; then 56, 52, and finally 48 in the 100 for the remainder. The carriages are drawn up by a steel rope of forty-nine strands, which is coated with tar as a protection against rust. An hour's drive from Naples takes the traveler to the mountain observatory. An excellent new road, nearly two miles long, has been built by the railway company from the observatory to the railway station. The ascent on the railway was made in seven minutes, but it can easily be made in five. The motion was quite smooth, but the sensation on looking out is far from pleasant, and a feeling akin to sea-sickness is said to arise. The view from the summit repays all the trouble. The writer says that at every step one feels the proximity of the great storehouse of heat. He was informed that great pillars of smoke frequently burst up from the ground, close to the spot where the railroad ends, and great chasms open, swallowing up anything which may be on the spot, so that the expedition may sometimes not be wholly free from danger. It was intended to open the line for the public at the beginning of May.

Saving is Wealth.

There is nothing new in this, but it is a subject fraught with so much importance to the young who would succeed in life, that it is well to refreshen their memories by often repeating the axiom.

Moreover, as the *American Pottery and Glassware Journal* says, waste and extravagance have been the bane of our times. Owing to these multitudes have become bankrupt, and because of them many are to-day unable to make any headway in the world. In the face of all the lessons of the past and of all the warnings of the present, there is a strong disposition to spend money recklessly in dress, equipages, entertainments, and innumerable useless ways. Stripling boys and young misses think nothing of devoting more every month to dress than clothed their fathers and mothers for a year; and yet they appear to no better advantage in society and are no more respected than were these same parents in their youthful days. Every cent they can make for themselves or wring from parents or friends is disposed of without any thought of the bad habits they are cultivating, of the demands of sickness and old age, or of the possible crimes to which they may expose themselves in the hour of temptation to meet the results of their outlays.

The great difference between those who save and those who do not in the struggle of life, consists not so much in early advantages or superior ability, other things being equal, as in the power to resist wasteful expenditure and sinful indulgences and to save something.

One evening lately, Hon. William E. Dodge, of New York, delivered an address embodying his recollections of New York for the last sixty years. Near the close he uttered these words, which should be carefully weighed by every young man and woman:

"In conclusion, permit me to say that, as I think of my early business life, I am impressed with the fact that those young men who were then known as industrious, high-minded youths, conscientious in the discharge of their duties, were those who succeeded in business on their own account; while many who had better opportunities failed, because they would indulge in pleasures which not only impaired confidence, but wasted what might have aided them in commencing for themselves. All young men should aim to save something each year, even at the expense of a limited wardrobe and many little things which they think necessities. If there were none but young men here, I would say that from the first year when I entered a store, with a salary of fifty dollars, to my last year—when as a salesman I received for those days very large pay—I never failed to save a portion; and when I started in business that sum and my experience were all my capital."

Epidemic Cycles.

Dr. Arthur Ransome, of Manchester, has been adding to his writings on epidemic diseases and allied subjects a very interesting and thoughtful paper on "Epidemic Cycles." Making use particularly of certain annual death rates which have been kept in Sweden since 1774, he finds in them, according to the *Lancet*, "internal evidence of accuracy in the characteristic peculiarities of the course of each disease," and holds that "they bear ample witness to the fact of the regular succession of epidemics in distinct cyclical periods." He has thrown the data from this source and from other sources into a series of diagrams, and from them he concludes that *whooping cough* has a cycle of about four years; *small pox*, before the introduction of vaccination, had a cycle of from four to five years; the cycle of *measles* is about seven years; while *scarlet fever* has an extended cycle of from fifteen to twenty years, when it recurs as a great visitation, fluctuations forming "less undulations," so to speak, occurring in the intervals. Dr. Ransome briefly considers the conditions which may probably determine the recurrence of these cycles, not omitting the question of possible relationship with the sun spot period. This question he illustrates by a most interesting diagram of the sun spot periods since 1775, but he is unable to trace any relationship between these periods and the epidemic cycles. He comes to the conclusion that the facts relating to the different cycles are susceptible of a simpler explanation than is commonly conceived. "A certain density of the population at susceptible ages," he says, "is necessary before a disease can spread with the vigor of an epidemic. Probably all the facts would be accounted for, if we suppose that these disorders can only become epidemic when the proximity between susceptible persons becomes sufficiently close for the infection to pass freely from one to the other. Exanthematous diseases rarely attack the same individual twice in his lifetime. When, therefore, an epidemic has, by either a fatal or non-fatal attack, cleared away nearly all the susceptible persons in a population, mostly infants and children up to a certain age, then it must necessarily wait a certain number of years before the requisite nearness of susceptible individuals has been again secured. There must in the intervals be a gradual restocking of the nation with material fit for the epidemic to feed upon, and it can only spread when the requisite proximity is attained, when meshes of the network of communication are sufficiently close for it to include all susceptible persons in one grand haul."

The Water Supply of Cities.

In a discussion in Congress, relative to the water supply of the District of Columbia, the following statement was given of the average daily *per capita* consumption of water in different cities, the figures being from official reports:

City.	Gallons.	City.	Gallons.
Providence	25	Detroit	108
Fall River	30	Chicago	119
Lowell	33	Washington	153
Lynn	34	New York	100
Rochester	35	Albany	81
Columbus	43	Jersey City	90
Lawrence	44	London (England)	29
Milwaukee	53	Liverpool (England)	23
Cambridge	55	Glasgow (Scotland)	50
St. Louis	56	Edinburgh (Scotland)	39
Cleveland	56	Dublin (Ireland)	25
Cincinnati	57	Paris (France)	29
Philadelphia	58	Tours (France)	27
Brooklyn	63	Toulouse (France)	26
Montreal	69	Lyons (France)	20
Boston	73	Leghorn (Italy)	30
Toronto	77	Berlin (Prussia)	20
Buffalo	87	Hamburg (Prussia)	33

New Industry for Petrolea.

The *Petrolea Topic* says: "It will be remembered that some time ago the enterprising refining firm of J. L. Englehart & Co. commenced the sinking of a well to the proposed depth of 2,000 feet, for the avowed purpose of testing the idea entertained that a hitherto undeveloped vein of petroleum lay far beneath the one at present worked at a depth of five hundred feet. The work on this 'deep well' has been unremittingly continued, and on Monday morning last, had reached a depth of 1,185 feet without developing anything specially novel. At this point, however, the drill plunged into a bed of pure salt, and up to the date of writing had bored through one hundred feet of this substance."

The Italian Exhibition.

At the Industrial Exhibition of Milan, in 1881, the leather industry will be especially represented by products from all parts of the country. Prof. Guido Susovy offers a prize of 600 lire ($150) for the best upper leather. The office of the executive committee of the Exhibition is located in Milan.

The leather manufacturers of Trente and Verona are considered to be at the head of the profession in Italy, the south of Italy being far behind in the tanning business. In tanning materials one firm in Monaco principally supplies the trade. Genoa is the great importing seaport for raw hides; Rome has the trade in calfskins, mostly imported from Chili; Leghorn has the African importation, and Venice that from the Orient.—*Shoe and Leather Reporter.*

RECENT DECISIONS RELATING TO PATENTS, COPYRIGHTS, ETC.

Supreme Court of the United States.

PARKS *et al.* vs. BOOTH.

1. It is essential to the validity of a patent that the particular invention be pointed out and distinguished from what is old, and when the invention consists merely of a new combination of old elements or devices, where nothing is or can be claimed except the new combination, it is sufficiently described to constitute a compliance with the letter and spirit of the law if the devices of which it is composed are specifically named, their mode of operation given, and the new and useful result to be accomplished is pointed out, so that those skilled in the art and the public may know the extent and nature of the claim and what the parts are which co-operate to do the work.

2. It is not necessary to allege or prove, in order to sustain the defense of prior patent or printed publication, that such patent or publication was issued or given two years earlier than the patentee's invention.

3. Where the patent covers an entirety it cannot be defeated by showing that the several component parts are old in other connections. It must appear that they have existed together in the same relation.

4. More than one patent may be included in one suit and more than one invention may be secured in the same patent, in which cases the several defenses of prior invention and public use may be made to each patent in the suit and to each invention to which the charge of infringement relates.

5. The patent act allows the infringer to plead and prove that the invention of the patentee had been in public use or on sale in this country for more than two years before the inventor applied for a patent; but no question of priority is open under that defense, nor will evidence sustain it that another had made or patented the invention two years before the application without the knowledge of the patentee whose invention is in question.

6. It not appearing that the complainant was guilty of laches in applying for a patent, or that *his improvement* ever went into public use or was on sale in this country before he applied for a patent, the patent was held to be valid.

7. Interest on the profits decreed to the complainant should not be allowed. The profits in such cases to be regarded in the light of unliquidated damages, which usually do not draw interest without the special order of the court.

Appeal from the Circuit Court of the United States for the Northern District of Ohio.

Mr. Justice Clifford delivered the opinion of the court.

U. S. Circuit Court—Southern District of New York.—Choate, J.

ROSSENBACH *vs.* DREYFUSS *et al.*—COPYRIGHT.

Decided April 28, 1880.

Section 4,963 of the Revised Statutes, providing that "every one who shall insert or impress such notice" [Entered according to act of Congress, in the year ——, by A. B., in the office of the Librarian of Congress, at Washington] "or words of the same purport in or upon any book, map, chart, musical composition, print, cut, engraving, or photograph, or other article for which he has not obtained a copyright, shall be liable to a penalty of one hundred dollars, recoverable one-half for the person who shall sue for such penalty and one-half to the use of the United States," is a penal statute to be strictly construed, and its terms cannot be extended beyond the case of articles subject to copyright, which is the limit indicated by the terms of the statute itself if read in connection with the other sections.

2. The purpose of the statute is to protect persons entitled to copyright from their privilege being impaired, and the offense against the statute is deceiving the public by the false assertion of a valuable privilege; but where the article marked as copyrighted is not the subject of copyright, neither the right of another is impaired nor can the public be deceived.

3. A print of a balloon or hanging basket, with printing indicating the embroidery and cutting lines, does not fall under either of the heads of "print," or "model or design intended to be perfected as a work of the fine arts," or "pictorial illustrations or works connected with the fine arts," enumerated in the copyright statutes.

4. Under the general rule of pleading that the plaintiff must state with reasonable certainty a case for recovery a demurrer was sustained where it did not appear by the complaints that the articles described therein were subjects of copyright under the laws of the United States.

By the Acting Commissioner of Patents.

HIBBARD *vs.* RICHMOND.—FEATHER DUSTERS.

Decided April 30, 1880.

Patent granted to Susan M. Hibbard May 30, 1876, No. 177,939. Application of Gilbert M. Richmond filed September 10, 1874.

NEW TRIAL:—Where in an interference between two applicants for a patent priority of invention was awarded to one of them and a patent issued accordingly: *Held*, that the issue of the patent constituted no bar to the reopening of the interference between the defeated applicant, whose application was pending in the Office, and the patentee, upon proof of fraud or newly-discovered evidence and in the absence of laches on the part of such applicant, and that upon proof on the new trial that the applicant was the original and first inventor he was entitled to the patent.

Appeal from Examiners-in-Chief.

United States Circuit Court.—District of New Hampshire.—Lowell, J.

PERKINS *vs.* NASHUA CARD AND GLAZED PAPER COMPANY.—WHAT CONSTITUTES PUBLIC USE.

Decided May 15, 1880.

There is very little conflict of evidence in this case. The patentee made a machine containing his invention in the year 1857, and in 1863 he substituted for it another, varying in form and proportions but not in principle. These machines he used successively in the ordinary way of his business as a maker of card and pasteboard until he applied for his patent in 1876. The specification and model represent precisely the machine of 1863.

During the time that the machines were used they stood in the room with several other machines necessary for the other processes of making, drying, and coloring pasteboard, and were operated chiefly by one man, Moulton, who was sometimes assisted by one other. About twenty-three workmen were employed upon the other parts of the manufacture.

The doors of the factory were usually kept locked, and each of the twenty-five workmen had a key. How many visitors came to the factory is one of the disputed points. There were occasional visitors, but not many persons came to the factory from mere curiosity.

During some months Mr. Denison, a friend of the patentee, was given the use of an upper room for making tags, and his workmen passed in sight of the pasting machine. It is not proved that any workmen, visitors, or other persons acquired or divulged a knowledge of the mode of operation of the machine until the workman Moulton gave that information to the defendants in 1876.

Was the invention in public use for more than two years before Perkins applied for his patent? The time was enough. Was the use a public use? The law desires to encourage inventors to make their discoveries known for the improvement of the art and to discourage an extension of the monopoly beyond the statutory period. For these reasons and because of the difficulty of ascertaining the amount of knowledge which may have been derived from the exhibition, publication, or use of the invention, it has always been held that when the public have had means of knowledge they have had knowledge of the invention. Thus if a book has been published describing the invention it is not important that no one has read it. (*Stead vs. Williams*, 7 M. & G., 818.) If a pier has been placed in the bed of a river or a pipe underground it is conclusively presumed to be known to all men. It has been intimated that a use in a workshop where the workmen are pledged to secrecy may not be a public use. (*Kendall vs. Winsor*, 21 How., 322; charge of Curtis, J., ; *Bevin vs. Easthampton Bell Company*, 9 Blatchf., 50; *Heath vs. Smith*, 3 Ellis & B., 255.) In the last of these cases it is held that if the invention has been worked in the ordinary way without an injunction of secrecy the use is public. In *McClurg vs. Kingsland* (1 How., 202), it is said by Mr. Justice Baldwin, *obiter*, that use in a factory is a public use. A use very trifling in amount, or a publication purely technical, or a single sale has often been held to deprive an inventor of his patent, without evidence that any one interested to acquire knowledge of the invention had acquired it. (*Henry vs. Providence Tool Company*, 14 O. G., 855, *Egbert vs. Lippman*, 14 O. G., 822; *McMillan vs. Barclay*, 5 Fish., 189; *Re* Adamson's patent, 6 DeG., M. & G., 420; *Patterson vs. Gaslight Company*, 3 App. Cas., 239; *Lange vs. Gisborne*, 31 Beav., 133.)

The difference between this case and *Manning vs. Cape Ann Isinglass Company* is that in that case the inventor after dissolving his partnership permitted his partner to continue to use the invention. Neither of the partners used the invention excepting in their respective factories (the circumstance makes that case a little stronger), but my opinion was that the use by the firm before they dissolved their partnership was a public use. Taking these decisions together, I understand the law to be that actual knowledge of the invention need not have been derived by any one interested to practice it. It is enough that any one or more persons not under a pledge of secrecy saw the invention practiced, or even might have seen it if they had used their opportunities, provided it was in fact practiced in the ordinary way after being completed. And it must be held either that the workmen and visitors were a part of the public or that they were persons from whom the public might have acquired the art without a breach of trust.

There was no pledge of secrecy proved here, and there was some evidence that none was exacted from anybody. There was no evidence of concealment except that the factory was not open to chance visitors. It was understood, I suppose, as most factories are conducted with no intention of divulging any secrets and none to have curious and prying persons admitted; but without any special precautions beyond what prudent men who do not care to be interrupted in their business would usually adopt. For my own part, I should have some doubt whether a pledge of secrecy exacted of a number of workmen who had nothing to do with the machine in question and had opportunity to examine it if they chose would make the use a secret one.

There is some evidence intended to prove that the use was experimental; but upon the whole record it is clear that the machines were used for about twenty years in the ordinary business of the patentee, and worked so well that when Moulton first expressed an intention of leaving the factory and building a machine for the defendants the plaintiff raised his wages one-third. He did not say it would involve a breach of trust.

A short time before the patent was applied for some experiments were made which resulted in nothing of importance, and, I fear, were intended to benefit the patent rather than the machine. An improvement has now been made, but it is not described in the specification shown in the model. At all events, a machine which, whether entirely satisfactory or not, has been run in the ordinary course of business for twenty or thirty years, and which is patented precisely as it was used, cannot properly be called an experimental machine.

The decree must therefore be, bill dismissed, with costs.

United States Circuit Court.—Southern District of New York.—Wheeler, J.

ALLEN *vs.* CITY OF NEW YORK.—FOLDING SEAT PATENT.

1. Reissued patent No. 31, to Aaron H. Allen, January 15, 1861, for improvements in seats for public halls, declared valid.

2. The seats in the original patent were to be turned up by weights, while in the reissue the weights may be dispensed with and the seats moved up otherwise: *Held*, that the reissue is not for an invention different from that contained in the original patent.

3. Although the stove door, carriage seat for a child, and opera board to a carriage, relied upon in defense, are turned down, stopped, and held and turned up out of the way as are these seats, such contrivances are not anticipations of this invention, since they could not be arranged as seats in public halls without additions and alteration requiring the exercise of invention.

4. A description in a prior patent is no anticipation of a patent the application of which was filed before the application of such prior patent.

5. The defendant in this case is a proper party to account for profits, as are also its board of education and department of instruction, by whom the seats constituting the infringement were introduced into the schools.

Decree sustaining the patent.

United States Circuit Court.—Southern District of New York.—Wheeler, J.

SHARP *vs.* TIFFT.—GAS STOVE PATENT.

Decided May 8, 1880.

1. Substantially the same combination of devices, although of different form and capacity, having been used before the patentee's invention, he is entitled only to his particular form of devices which are really different, and the combination of those devices with each other or with others so as to produce a new result or an old result in a new way.

2. A reference in a disclaimer to a particular form of the device not so limited in the claim is merely descriptive of that form without taking away or adding anything thereto.

3. When the reissue describes only what was described in the original patent, both as to the devices and the nature of the invention, it cannot be said that the invention in one is different from that in the other, although the claims have been changed and enlarged.

4. A patent for a combination of known parts, materials, or elements is not infringed by the use of any number of the parts, materials, or elements less than the whole.

5. Where some parts of the combination are new, and those parts are taken and used in the same manner, but with different elements for the rest of the combination patented, a part of the invention is taken, although the whole is not, and it is an infringement to that extent.

6. A disclaimer filed after the suit was brought ordinarily deprives the plaintiff of costs in the suit; but where the disclaimer was not necessary to sustain the patent to the extent it is held valid, was inoperative, in the view taken of it, upon the patent, and has no effect in maintaining the suit, cost may be allowed the plaintiff as though no disclaimer had been filed.

Test for Organic Impurities in Water.

The use of a dilute solution of tannic acid has been suggested for this purpose by J. P. Dahlen. The test solution should contain five per cent of tannin, and five parts of it should be added to one hundred of the water. If organic matters be present, a pellicle or scum will rapidly form; this scum formation can be recognized by the immediate appearance of an iridescence or play of colors, and the growth of fungus vegetation can be detected without a microscope by the little bubbles of carbonic acid which collect around the edges of the surface. In every sample of water where this turbidity or scum is formed, or where a fungoid growth occurs soon after addition of the tannin solution, it is a sure sign that organic matters are present. When these organic matters have been destroyed by evaporating, heating, etc., no such turbidity or fungoid growth occurs on addition of the tannin solution.

Train Wrecking in Spain.

A gang of train wreckers have met with the kind of punishment in old Spain which we would like to see that class meet with in this country. A gang which recently wrecked a train in Andalusia was court-martialed, thirteen of them sentenced to death and thirteen to imprisonment for twenty years. This country stands very much in need of Spanish civilization, and if it could be introduced into Illinois, Missouri, Iowa, and certain other parts where the industry of train wrecking and robbing is followed with considerable success it would be a good thing.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

GEM CITY TOBACCO WORKS, QUINCY, ILL., May 21, '80.
H. W. Johns M'f'g Co., 87 Maiden Lane, New York.

DEAR SIR: Please give us lowest figures on Asbestos Roofing. We bought several years ago 300 squares. . . . We are talking up your roofing wherever we have a chance. (Signed) M. GOODMAN, Secretary.

Foundry and Machine Shop.—A Practical Moulder wanted as Partner in a long established business. For particulars apply to or address W. H. McKeldin, Athens, McMinn County, E. Tenn.

For Sale.—A Baltimore City Fire Department Steam Fire Engine, in complete working order. Address P. O. Box 670, Baltimore, Md.

For Jack Chain Machines, making from 60 to 100 links per minute, direct from the coil, address Cross & Speirs, Waterbury, Conn.

The easiest Writing Pen made—the Chezine—by the Esterbrook Steel Pen Company, 26 John St., New York. Price $1 per gross.

About $2,500 will buy a small Machine Shop. Can be seen at 136 Broadway, Newburg, N. Y.

Wanted—A good reliable person, who has sufficient means to apply for foreign patents for a valuable invention. Address George S. Agee, Mt. Hill, Osage Co., Mo.

Metallic Piston Rod Packing Company, 773 Broad St., Newark, N. J. Agents wanted; terms liberal.

For Sale.—Patent for Perpetual Calendar Inkstand, illustrated in this paper, together with moulds, and a list of 5,000 stationers. Address S. M. Howard, Administrator, 1207 Main St., Wheeling, W. Va.

Lubricene, Gear Grease, Cylinder and Machinery Oils. E. J. Chard, 6 Burling Slip, New York.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders and withdraw their illustrated advertisement. Send for their new circulars.

Patent Steam Cranes. See illus. adv., page 381.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 49 & 50 Astor House, N.Y.

Asbestos Board on Chimneys prevents their heat from affecting the temperature of rooms through which they pass. Asbestos Pat. Fiber Co., lim., 194 Broadway, N. Y.

Wilson's Business Directory, second edition, and Wilson's Co-partnership Directory for 1880-81, are now ready. Price, $5 each. All orders addressed to the Trow City Directory Company, No. 11 University Place, New York, promptly attended to.

$5 to $50. A County Right. A Clothes Line Fastener. Sample by mail, 25 cents. J. A. Worley, Cleveland, O.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co. 52 Dey St., N.Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Steel Figures, $1; Letters, $3 a set. York & S., Clev., O.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 365.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Forsaith & Co., Manchester, N. H., & 207 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 394.

Eclipse Portable Engine. See illustrated adv., p. 349.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

4 to 40 H. P. Steam Engines. See adv. p. 348.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Blake "Lion and Eagle" Imp'd Crusher. See p. 365.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 380.

Peck's Patent Drop Press. See adv., page 364.

Air Compressors, Blowing Engines, Steam Pumping Machinery, Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. Important, that users should have prices of these first class goods. American Twist Drill Co., Meredith Ville, N. H.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 382.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

For Standard Turbine, see last or next number.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Wanted—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

$875 Horizontal Engine, 20 H. P. See page 381.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 381.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For Wood-Working Machinery, see illus. adv. p. 380.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 381.

For Separators, Farm & Vertical Engines, see adv. p. 381.

Best American Shot Gun made is the "Colts." Far superior to any English guns for the same price. For description, see Sci. AMERICAN of May 29. Send for circular to Hodgkins & Haigh, Dealers in General Sporting Goods, 300 Broadway, New York.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 381.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 381.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 381.

For Middlings, Mill and Mill Furnishing, see adv. p. 381.

C. J. Pitt & Co., Show Case Manufacturers, 295 Canal St., New York. Orders promptly attended to. Send for illustrated catalogue with prices.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 380.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Solomon's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Penfield (Pulley) Block Works. See illus. adv. p. 381.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

For Patent Shapers and Planers, see ills. adv. p. 380.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN HOYLE. Dick & Fitzgerald, New York. Price $2.

A revised edition of this authoritative hand book of games, rewritten and adapted to the American method of playing, has just been issued. The compiler claims for this book the most recent and reliable rules practiced in this country. A chapter on the doctrine of chances embraces curious problems which interest every one.

ON THE GHOSTS IN RUTHERFURD'S DIFFRACTION SPECTRA. By C. S. Peirce. 4to, pp. 17.

A QUINCUNCIAL PROJECTION OF THE SPHERE. By C. S. Peirce. 4to, pp. 3, with Chart of the World on a Quincuncial Projection.

Two important contributions to exact science, published by the authority of the Superintendent of the United States Coast and Geodetic Survey, in the American Journal of Mathematics, Vol. II., 1879. The quincuncial projection which Mr. Peirce has invented possesses the following properties: 1. The whole sphere is represented on repeating squares. 2. The part where the exaggeration of scale amounts to double that at the center is only 9 per cent of the area of the sphere, against 13 per cent for Mercator's and 20 per cent for the stereographic. 3. The angles are exactly preserved. 4. The curvature of lines representing great circles is in every case very slight over the greater part of their length.

METHODS AND RESULTS. NOTE ON THE THEORY OF THE ECONOMY OF RESEARCH. By C. S. Peirce. Quarto, pp. 7.—MEASUREMENTS OF GRAVITY AT INITIAL STATIONS IN AMERICA AND EUROPE. By C. S. Peirce. Quarto, pp. 145. Washington: U. S. Government Printing Office. 1879.

These valuable reports are reprinted from the Report of the United States Coast Survey for 1876, to which they form appendices No. 14 and No. 15.

TWELFTH AND THIRTEENTH ANNUAL REPORTS OF THE TRUSTEES OF THE PEABODY MUSEUM OF AMERICAN ARCHÆOLOGY AND ETHNOLOGY. Cambridge: 1879 and 1880. Vol. II. Nos. 3 and 4.

In addition to matters purely official these reports contain reports by the Curator on the progress of special explorations under the direction of the museum, and valuable papers by gentlemen engaged in such work. A large part of the Twelfth Report is occupied by the third part of Ad. F. Bandelier's elaborate study of the social organization and mode of government of the ancient Mexicans.

THE STANDARD SERIES. New York: I. K. Funk & Co.

Five years ago, in an article entitled "A New Style of Bookmaking Needed," the SCIENTIFIC AMERICAN expressed the successful book maker of the future would print for the million as well as for the few and be the gainer by it; and that any responsible firm which should enter at once upon the work of publishing good books, especially scientific books, at a quarter the usual price would achieve a splendid success. But they would have to print editions of a hundred thousand. Since that day the business of publishing in cheap form books of temporary interest, chiefly novels, has developed wonderfully; but it has been left for Messrs. Funk & Co. to do the same with books of sterling value, such as we called for so long ago; and they are printing them on legible type, using a good quality of white paper, at rates that are marvelously low. For example there have come to our table Ruskin's Letters to Workmen and Laborers (Fors Clavigera) in two parts, at 15 cents each; Carlyle's Essays on Goethe, Burns, Luther's Psalm, Schiller, Memoirs of Mirabeau, and Death of Goethe, complete in one volume for 20 cents; John Stuart Blackie's three Essays on Self-Culture together, 10 cents; and Knight's Popular History of England, in eight volumes, at 80 cents each, or no more for the entire work than a single volume has cost hitherto. Enterprise and sound judgment of this sort deserve, and we are confident will win, the highest success. The books which are thus placed within the easy reach of the million are such as the million may read with pleasure and profit.

COMMON MIND TROUBLES, AND THE SECRET OF A CLEAR HEAD. By J. Mortimer Granville, M.D., etc. Philadelphia: D. G. Brinton. 1880.

Dr. Granville discusses in a sensible practical way mental and moral failings, defects of memory, confusions of thought, sleeplessness, low spirits, good and bad tempers, etc., and the American editor adds in the same vein chapters on "mental languor and listlessness," and "morbid fear." The second part enforces the lessons taught in the first part and tells how to keep the head clear and the mind efficient. The work is hopeful, thoughtful, and cannot fail to be useful.

MULTIPLICATION AND DIVISION TABLE. By Leonard Waldo, S. D. (Harv.) New York: John Wiley & Sons. 1880. Folio, pp. 4.

This table, containing the product of numbers between one and one hundred, is intended for the use of accountants, computers, and teachers in primary schools. The arrangement of the table is excellent; and, if the large size of the pages does not make it awkward to handle, it cannot fail to greatly facilitate computation.

REPORT OF THE NEW YORK STATE SURVEY FOR 1879. THE NIAGARA FALLS RESERVATION. By James T. Gardner, Director. Albany: Charles Van Benthusen & Sons. 1880.

The first and larger part of this Report is devoted to the examination of the lands around Niagara Falls, with reference to their convenience into a sort of International Park. Part II. covers the work of the general State survey, during the past year, in Onondaga, Oswego, Madison, and Oneida counties. The Report is accompanied by a map of Eastern and Central New York, showing the results, of accurate survey; and the first part is illustrated by a number of heliotype prints of photographs of Niagara scenery.

REPORT OF THE STATE ENGINEER TO THE LEGISLATURE OF CALIFORNIA, SESSION OF 1880. Sacramento: State Office.

In this report State Engineer Hall reviews: 1. The year's operation of the department; 2. The drainage of California valleys, and the improvement of the navigation of the rivers; 3. The flow of mining detritus; 4. The irrigation of the plains; 5. Present condition of the inquiry with regard to California river improvement, storage and disposal of mining detritus, and irrigation.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) W. P. B. asks: 1. Will not a galvanic battery containing fifty cells become exhausted as soon as one containing but one cell? A. If the work performed is proportionately the same there will be no difference. 2. Is there any way of regulating the consumption of the zincs of a battery, as of coal in a furnace? A. Keep the zincs well amalgamated, and keep them out of the solution when the battery is not in use. This does not apply to sulphate of copper batteries. 3. What dimensions must I follow, if there is any fixed rule, in making electro-magnets of any lifting capacity I may desire? A. As the lifting power of magnets depends on many conditions, no fixed rule can be given. You will find in any good work on electricity rules which will enable you to determine approximately the size of electro-magnets for a given capacity.

(2) J. I. H. writes: I have a piece of table land with a gulch 250 feet deep on it. Fifty feet from the bottom is a spring running a two inch stream. By putting a hydraulic ram in the bottom of the gulch, I will have a head of fifty feet. Will a ram throw a stream to the top of the gulch? A. Yes, you will probably lift one-eighth to one-tenth the quantity of water running to the same from your spring to the top of the gulch.

(3) G. R. B. writes: In SCIENTIFIC AMERICAN, Vol. xlii., No. 15, you state in answer (10) to E. E. G. that it requires 106 lb. pressure to raise the safety valve under the given conditions. Please give the formula for obtaining said calculation, and oblige your reader. A. The lever is taken at 8 inches length from the valve = 21 lb. on the valve (excluding weight of lever), and $\frac{21\cdot000}{0\cdot1960} = 106$ lb. nearly.

(4) W. S. F. asks what to apply to cloth to make it suitable for a small pair of bellows. A. Dissolve gum caoutchouc (native rubber) in about five times its weight of benzine or naphtha by digestion over a hot water bath away from fire. To one part of this solution add eight parts of boiled oil (warm), strain and keep warm (by a hot water jacket) while using.

(5) A. F. O. asks: Why must the materials of the gelatin printing pad be heated in a salt water bath? Suppose I use a simple fresh water bath, what then? A. The boiling point of salt water is higher than that of fresh. A greater heat may thus be obtained without danger of burning the composition.

(6) I. A. R. asks: 1. Is it possible so to destroy mill picks in tempering that they cannot afterward be tempered so as to be of any use? A. Yes. 2. Is milling a science or an art? A. Both. 3. What is the best modern work on milling? A. "Craik's Millwright and Miller."

(7) D. G. W. asks: Why does it take more length of piston rod to drive an engine's crank pin from one dead center to the quarter than it does from the quarter to the other dead center? A. Because of the angle of the connecting rod. If you drive the crank pin by a "slotted" cross head, you will find no such difference.

(8) R. K. writes: I wish to know if it would be advisable to run a steam hammer 166 feet from the boiler, even if the pipe was lagged with felt? If I get a steam hammer, I will have to use the boiler that distance or get a separate boiler. A. You can drive the steam hammer as you propose, but the steam pipe should be of large size, well protected, and a provision made for drawing off the water of condensation.

(9) G. F. W. writes: One of the hands says a piece of steel, ¼ inch thick, taken from the tempering fire and allowed its own time to cool, will continue to draw while cooling, while I say the color changes but the temper does not. A. We are of the opinion that the temper changes with the color; the color is the index of the temper.

(10) R. D. asks: Can the telephone described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 142, page 2261, be made to talk over 50 feet of cotton covered wire by using a battery? A. Yes; use some form of carbon transmitter in connection with it.

(11) E. F. C. writes: 1. In constructing a steam boiler from mercury flasks, as described in your SUPPLEMENT, how many would I need to produce one horse power? A. Eight, six for water and two for steam chamber. 2. I understand that with a magneto-electric machine, properly arranged, an amount of power may be generated greatly superior to the primary source or inducing power. Why is this? Can the same be accomplished with an induction coil; if not, why? A. You are misinformed. The magneto-electric machine does not create power.

(12) W. H. W. asks: 1. What is the power required to drive the dynamo-electric machine described in SUPPLEMENT 161? A. One man power. 2. Can it be used to electro-plate small articles? A. Yes.

(13) W. R. M. asks: What shall I use to cement the edges of window glass to make a salt water aquarium? A. See receipt for aquarium cement, SUPPLEMENT, No. 137.

(14) T. S. B. asks: 1. What is the best pickle for cleaning brass castings? A. Use a nitric acid bath. Do not allow the articles to remain too long in this. 2. How are steel faces welded on cast iron anvils? A. By placing the steel in position in the mould and pouring in the melted iron.

(15) A. T. B. asks for a receipt for lacquer for brass, one that is thoroughly practical. A. Spirit of wine, 2 quarts; shellac, 2½ oz.; gum sandarac, ½ oz.; gum elemi, ½ oz.; mix and keep gently warmed for several days; strain, color with dragon's blood, and thin with 1 quart spirit of wine.

(16) C. M. M. asks: What is the cheapest fluid that will undergo exposure in pipes to a minimum temperature of 30° Fah. below zero without congealing, or becoming too viscid to flow readily at a velocity of 2 feet per second in a 1½ inch pipe—exposure to be for a protracted period? A. Have you tried a saturated aqueous solution of common salt and sulphate of soda?

(17) B. S. asks: 1. How can I ascertain the capacity of a centrifugal pump at different speeds? Its utmost capacity, I presume, would be the quantity of water contained in 500 feet of its suction pipe. A. There is no general rule, as it much depends upon the construction of the pump and height to which the water is to be lifted; the quantity of water in the pipe has little influence upon the quantity delivered. 2. Will not a centrifugal pump lift water with as much ease if placed 20 feet above the level of the water, as it would if only placed 5 or 10 feet above it? A. No; as the smallest air leak would have greater prejudicial effect.

(18) G. S. H. asks: 1. Can you give me an ink that may be applied to enameled calling or playing cards that will show perfectly plain, and that will not destroy the gloss; also tell me how to apply it? I wish a dark blue color, such as is often seen on the back of playing cards. A. Try printer's ink diluted with oil of lavender.

(19) J. L. P. writes: 1. I am building a fountain. Water pumped into reservoir 10 feet from ground by wind engine. Fountain a ¼ inch jet fed

through a one inch gas pipe 30 feet from reservoir. Will I get about a 9½ foot jet? A. No; only 8½ to 9 feet. 2. How much water will it require to keep jet playing 24 hours under 10 feet head? A. About 160 gallons per hour. 3. What sized tub will I need to hold the required amount of water? A. Equal in capacity to say 100 barrels for 24 hours. 4. Is there any danger from spontaneous combustion when 5 or 6 tons fine coal slack is piled in corner of a building out of doors exposed to weather? A. There is danger if it is slack of bituminous coal.

(20) L. S. N. asks: How can I bleach or restore a switch of white hair which has turned yellow? A. Clean thoroughly and expose it moist to the vapor of burning sulphur in a box.

(21) A. A. B. asks: In a hot day does a person feel the heat more or less when the humidity is at its highest? A. An increase in humidity renders a warm atmosphere more oppressive.

(22) D. K. writes: Herewith please find a specimen of baryta found in this country. Will you be kind enough to answer through the proper column of your valuable journal the three following questions, namely: What the conditions are under which it is found in the earth; whether in veins or pockets? What its commercial value is both in its raw and manufactured state? What uses is it put to in the arts, etc.? A. Barite (called barytes and baryta), barium sulphate, occurs commonly in connection with beds or veins of metallic ores as part of the gangue. It is met with in secondary limestones, sometimes forming distinct veins, and often in crystals along with calcite and celestite. Its chief use in the arts is for the preparation of certain white pigments, as permanent white, Derbyshire white, etc., and for adulterating white lead. The fine ground mineral is quoted at ¾ to 1 cent per lb., barreled (600 to 700 lb. per barrel).

(23) J. H. A. asks: 1. How many yards should a suction pump draw water from a river up an incline of 15 feet? A. There is almost no limit if the pipe be perfectly tight and of sufficient size. 2. Does it not require less power to draw a given quantity through a large pipe than through a smaller one? A. Yes, within reasonable limits. 3. Would a (water tight) sleeve answer for the suction pipe? And if not, and the sleeve is not entirely tight, would it answer if buried one or more feet in the ground? A. If it is tight, yes; if not tight, burying in the earth will be of no benefit. 4. Would a valve on the lower end of a suction pipe be any advantage? A. Yes.

(24) F. E. B. asks: What light cheap substance can be put in a lath and plaster wall to deaden as much as possible sounds from one room to another? A. Dry saw dust or spent tan bark, well dried, is good. Sand would be effectual if the lathing is sufficiently strong to admit of its use.

(25) C. W. Y. asks how to prepare and polish shells (sea shells.) A. Porcelainous shells are so hard as to require the apparatus of a lapidary to cut or polish them, but they are generally so smooth as to require no rough grinding. They may be polished by using a felt wheel and applying putty powder. Nacreous shells or those of the pearl variety may be filed and cut without a great deal of difficulty. Pieces to be turned are first roughly shaped on the grindstone, then turned and polished with pumice stone, putting on the final polish with rotten stone. Irregularly shaped pieces are filed and ground, then smoothed with pumice stone and water, and finished with rottenstone. The rotten stone is sometimes mixed with sulphuric acid full strength, or slightly diluted to heighten the polish.

(26) C. W. F. asks: What will remove wheel grease from woolen material without injuring the color of the fabric? A. Have you tried naphtha or benzine? They affect neither goods nor colors.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. G. S.—1. A ferruginous slag—probably from some blast furnace. 2. Clay ironstone seamed with iron and copper pyrites. 3. A conglomerate sandstone; not ancient pottery. The supposed straw marks are ripple marks (from the action of water).—E. G. A.—1. Syenite. 2. Chiefly iron sulphide. 3. Graphite (plumbago) of some value. 4. Pyrrhotine (an iron sulphuret) containing a little copper. This ore may also contain silver. 5. Tourmaline.—C. D. G.—1. A cheap paint could be produced from it, but it would hardly repay the cost of the grinding, washing, roasting, and bolting necessary. 2. Would probably make a soft brick.—Mrs. C. F. W.—The "diamonds" are composed of silicic acid; much worn—by the water. They are worth about $100—an acre.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

May 18, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Air cooling apparatus, O. Kropff ... 227,796
Amalgamator, C. E. Ball ... 227,716, 227,717
Amalgamator, C. E. & R. E. Ball ... 227,719
Annunciator, electric, C. H. Perkins ... 227,734
Anti friction composition for bearings, J. Smalley ... 227,940
Axle, vehicle, Doolittle & Curtiss ... 227,670
Axle, wagon, J. B. Harman ... 227,773
Baking pan, A. W. Morgan ... 227,814
Bale wire inserting and bale dividing device, P. K. Dederick ... 227,636
Baling machine, hay, P. K. Dederick ... 227,637
Baling press, P. K. Dederick ... 227,627
Ball trap, B. Hempstead ... 227,778
Barrel swing, S. W. Sheldon ... 227,948
Binder, temporary, W. H. Bailey ... 227,715
Binder, temporary, R. Morris ... 227,899
Boat gang plank, A. K. Quinby ... 227,904
Boot and shoe, rubber, W. R. Miller ... 227,811
Boot and shoe sole buffer, J. W. Rogers ... 227,920
Boot treeing apparatus, Ambler & Wires ... 227,800
Boots and shoes, horn bearing for, Hodson & Burrill ... 227,831
Brick machine, W. B. Aitken ... 227,698
Bridge gate, C. C. Claussen ... 227,853
Bridge guard, P. Walling ... 227,964
Bridle binder, Gregerson & Weymouth ... 227,764
Brushing animals, machine for, N. Stow ... 227,937
Buckle, A. L. France ... 227,755
Buckle, I. L. Landis ... 227,790
Buckle, harness, H. W. Fuller ... 227,759
Bullet and shot machine, G. W. McCreary ... 227,907
Burial casket, J. A. Meyer ... 227,909
Button and stud, J. Newman ... 227,790
Button, detachable, D. S. Cooke ... 227,735
Button, separable, H. A. Carter ... 227,730
Can filling apparatus, G. H. Perkins ... 227,826
Can spout, T. C. Massey ... 227,897
Canals, etc., lock and lock gate for, Pouchet & Vasserean ... 227,831
Candle holder, J. W. Spear ... 227,660
Car coupling, W. N. Harting ... 227,770
Car coupling, S. F. Newland ... 227,819
Car coupling tool, W. G. Hurd ... 227,780
Car stock, E. G. Frisbie ... 227,754
Carbureter, C. W. Soule ... 227,928
Carding machine feeding device, J. H. Brackett ... 227,633
Carding machines, fleece dividing attachment for condensers for, J. S. Bolette ... 227,621
Carpet stretcher, P. D. Houpt ... 227,784
Carriage curtain fastening, C. Fockler ... 227,732
Carriage top, C. Fockler ... 227,731
Casting metals on a chill, mould for, T. M. Bissell ... 227,607
Chains, slip link for coupling, F. Kingston ... 227,798
Chair, Dexter & Chase ... 227,639
Chair for attaching to door steps, etc., E. K. Porter ... 227,902
Chenille twisting machine, F. W. Happelsberg ... 227,768
Christmas tree candle holder, J. A. Kiesele ... 227,803
Churn cover, M. O. Stoddard ... 227,856
Clay and mortar, tempering wheel for, C. W. Raymond ... 227,935
Clock, electric circuit breaking, E. Holmes (r) ... 9,249
Clothes rack and mantle, combined, C. C. Field ... 227,749
Cock for beer and other casks, two-way, P. Krug ... 227,267
Coffee grinding mill, J. C. Dell ... 227,742
Coffee pot, C. F. Matthes ... 227,905
Coffin handle socket, C. F. Mosman ... 227,817
Coffin handle tip, C. F. Mosman ... 227,816
Compound engine, M. B. Harvey ... 227,772
Copies of writing, producing multiple, E. Holtzmann ... 227,629
Cotton chopper, J. Warren ... 227,964
Cotton scraper, H. L. Lyon ... 227,902
Cotton, treating seed, W. P. Groom ... 227,767
Crucible furnace burner, Snow & Seumans ... 227,932
Cultivator, J. W. Davis ... 227,741
Cultivator, J. A. Gogel ... 227,667
Ditching machine, J. A. Bailey ... 227,651
Door securer, J. Armstrong ... 227,713
Duster, feather, G. M. Richmond ... 227,837
Eaves trough hanger, F. Otto ... 227,302
Egg carrier, W. H. Wolfe ... 227,670
Egg tongs, R. P. M. Koska ... 227,693
Ejector, H. Cull (r) ... 9,120
Electric machine, dynamo, W. Sawyer ... 227,845
Electric switch cords, tip for, S. H. Boddish ... 227,722
Electro-magnetic motor, W. W. Griscom ... 227,622, 227,623
Elevator, A. J. & R. S. Whittier ... 227,968
Elevator safety stop, F. Laufkotter ... 227,793
Embalming, S. Rodgers ... 227,654
Envelope, E. O. Bicknell ... 227,721
Fanning mill sieve, E. Harris ... 227,635
Fence post boring machine, K. Freeman ... 227,757
Fertilizer distributer, F. B. Glasscock ... 227,762
Filter, reversible, B. T. Loomis ... 227,800
Filtering liquids, apparatus for, C. Ross ... 227,840
Fire kindler, C. H. Hayden (r) ... 9,301
Forge and steam boiler, combined, D. E. Engle ... 227,740
Furnace and apparatus for smelting ores and condensing fumes, H. W. Adams ... 227,710
Galvanic battery, W. V. Lockwood ... 227,801
Galvanic battery case, J. H. C. Watts ... 227,965
Gas meter, T. C. Hopper ... 227,783
Gas pressure regulator and indicator, F. W. Wiesebrock ... 227,867
Gasoline burner, W. C. North ... 227,791
Gate closing device, J. Kohnmann ... 227,790
Gig and bounder, F. C. Butler ... 227,680
Glass presses, clamp for securing plungers in, J. R. Bridges ... 227,609
Globe, Arkell & Richmond ... 227,713
Grain cutting machine, Heston & Purdy ... 227,626
Grain elevator, S. W. Neall ... 227,820
Grain meter, J. W. Hill ... 227,669
Grubber, W. R. Downing ... 227,620
Gun, air, A. G. Hyde ... 227,790
Guns, tripod support for machine, F. G. Parkhurst ... 227,648
Harness pads, machine for forming, W. R. Ferguson ... 227,749
Harrow, C. H. Rotner ... 227,936
Harrow, W. L. Waddy ... 227,862
Harrow or cultivator, Bramer & Crowley ... 227,724
Harrow tooth, W. S. Foster ... 227,605
Hay press, G. Kriel ... 227,891
Headlight, J. Hirth ... 227,822
Headlight case, R. C. Greenland ... 227,763
Heating and ventilating, C. M. Woodward ... 227,770
Heel and shank supporter, D. F. McKittrick ... 227,909
Hinge, gate, W. W. Robinson ... 227,824
Hinge spring, D. W. Bonney ... 227,784
Horse detacher, W. G. Cummings ... 227,740
Horse detacher, A. Ohlson ... 227,821
Horse power, J. B. Elward ... 227,745
Hub, vehicle wheel, D. May ... 227,806
Hydraulic pipe, D. G. Phipps ... 227,830
Ice cream freezer, Whitney & Killam ... 227,665
Ice making apparatus, C. C. Palmer ... 227,708
Insects, wire cloth fan for the destruction of, M. K. Taylor ... 227,706
Ironing table, folding, J. M. Shoaf ... 227,659
Journal box, A. Higley ... 227,627
Key hole guard, J. H. Browne ... 227,725
Knitting needles, machine for making the tongues of machine, W. Aiken (r) ... 9,296
Label, botanical, C. J. Schultz ... 227,656
Lamp, R. Cartwright ... 227,731
Lamp, street, G. P. Ganster ... 227,760
Latch, reversible, M. C. Niles ... 227,642
Life preserver, buoy, and boat, J. G. Hill ... 227,779
Leather, device for automatically measuring the superficial area of sides of, Tapley & Porter (r) ... 9,256
Lime kiln, W. A. Page ... 227,972
Lithographic process, A. Hoen ... 227,782
Locomotive engine, W. P. Hensey ... 227,778
Loom shuttle box mechanism, L. J. Knowles ... 227,654
Loom shuttle box motion, H. Wyman ... 227,697
Magnets, armature for electro, P. Wagner ... 227,863
Meat into cans, machine for packing, W. Stoenewald ... 227,854
Meat press, A. Thurston ... 227,960
Mechanical motor, Bannell & Tenney ... 227,729
Medicine case, Barnett & Hurlburt ... 227,719
Metal cutting shears, J. H. Gee ... 227,694
Metal, roller die machine for the manufacture of articles from, G. J. Capewell ... 227,631
Mineral water and charging liquids with nature's carbonic acid gas, apparatus for collecting natural, A. K. McMurray ... 227,698
Motion, device for converting, J. H. Townley ... 227,702
Musical instrument, mechanical, O. H. Arno ... 227,714
Nut lock, J. Hemp ... 227,775
Nut lock, W. P. Miller ... 227,812
Nut lock, W. S. Mitchell ... 227,693
Nut lock, J. G. Thompson ... 227,663
Oil press mat, Archer & Pope ... 227,670
Ore roasting furnace, W. C. Munroe ... 227,818
Ores, chlorinating, J. H. Mears (r) ... 9,293
Oven indicator, baker's, C. Pischer ... 227,620
Oysters, float for fattening, L. J. Stewart ... 227,663
Paper bag machine, M. E. Knight (r) ... 9,282
Paper cutting machine, A. Main ... 227,608
Paper pump from straw, etc., manufacture of, C. O. & H. A. Chapin ... 227,676
Paper pulp, preparing wood for making, W. R. Patrick ... 227,646, 227,647
Pavement, concrete, D. W. Bailey (r) ... 9,287
Phonograph, T. A. Edison ... 227,679
Piano action frame, upright, G. M. Guild ... 227,624
Pie making machine, Hoffman & Moody ... 227,681
Piers, drift wheel for, G. M. Fenley ... 227,747
Pigeon trap, H. M. Miller ... 227,689
Pipe wrench, G. W. Griffiths ... 227,769
Planter, corn, W. C. Peckham ... 227,829
Planter, hand corn, J. M. Harrison ... 227,769
Planters, adjustable feed plate for corn, S. N. Hart ... 227,771
Planters, check rower rope for corn, J. W. Hudson ... 227,797
Plow, S. L. Allen ... 227,606
Plow, one wheel, H. Borchert ... 227,720
Pocketbook, C. W. Jenks ... 227,691
Pocketbook and satchel handle, C. W. Jenks ... 227,692
Pocketknife, J. D. Frary ... 227,751
Potato fork, T. C. Baxter ... 227,720
Press gauge, G. H. Perkins ... 227,827
Presses, blank guard for die, Perkins & McNaught ... 227,829
Pressure regulator, Guild, Horne & Corning ... 227,766
Protractor, G. Saint ... 227,844
Pump, W. M. Gibson ... 227,761
Pump, etc., E. Reynolds ... 227,660
Pump, steam fire engine, A. G. Bonan ... 227,625
Railway, C. F. Buschner ... 227,729
Railway switch, W. Miller ... 227,680
Railway torn out, J. W. Kramer ... 227,796
Railways, permanent way for, G. Schwartzkopff ... 227,725
Rake and tedder, combined, B. J. Colvin ... 227,734
Reaper and harvester binding attachment, J. D. Heebner ... 227,774
Rein holder, S. M. Wright ... 227,871
Rivet, tubular, M. Bray ... 227,613
Rolling iron, steel, etc., roll for, H. B. Comer ... 227,737
Rolling mill, H. Matheson ... 227,808
Roof, composite, Foster & Benton ... 227,602
Sash fastening, H. F. Price ... 227,680
Saw, E. Morris ... 227,863
Scales, device for delivering groceries to counter, J. T. Hodge ... 227,780
Scales, spring, C. C. & S. B. Parker ... 227,645
Seaming machine, can, G. H. Perkins ... 227,928, 227,824
Sewer trap, automatic, M. B. Cowden ... 227,614
Sewing machine, T. Crane (r) ... 9,298
Sewing machine eyelet hole attachment, G. M. Morris ... 227,640
Sewing machines, bobbin holder or ring slide for, C. & D. K. Marsh ... 227,806
Shaft hanger, bracket, and post, A. Lochner ... 227,804
Sheet metal, machine for wiring and flanging, A. & C. Scherb ... 227,846
Shipping can, E. M. Crandal ... 227,615
Slate frame, M. W. Brown ... 227,674
Slate frame, G. B. Thompson ... 227,662
Smoke box and stack for locomotives, J. K. Sampsel ... 227,657
Snow plow, I. N. Rosenfeld ... 227,941
Soap, etc., adjustable cutter for cutting, L. M. O'Donel ... 227,643
Soldering machine, Dillon & Cleary (r) ... 9,296
Soldering machine, G. H. Perkins ... 227,826
Sound articulator, O. D. Orvis ... 227,644
Spark arrester, M. Rumely ... 227,650
Spinning machines, under clearer spring for cotton, J. Brown ... 227,680
Stake pin, Carnes, Sr., & Penfield ... 227,675
Steam boiler, J. N. Farnham ... 227,621
Steam boiler and furnace, W. Moore ... 227,813
Steam engine, A. & S. J. Covey ... 227,739
Steam engine, Fort & Scott ... 227,753
Steam engines, marine and other, L. Perkins ... 227,828
Steering apparatus, steam or hydraulic, J. Gates (r) ... 9,300
Stirrup strap attachment, J. Ball ... 227,727
Stone cutting machine, S. B. Frank ... 227,758
Stove pipe shelf, M. B. Coburn ... 227,733
Stove, school house, J. Grossius ... 227,766
Straw carrier, W. Pierpont ... 227,649
Switch stand and interlocking apparatus, J. T. Halsey ... 227,690
Table leaf support, D. T. Clemons ... 227,732
Telegraph, printing, C. J. Wiley ... 227,868, 227,869
Telegraph relay and sounder, S. D. Field ... 227,750
Telegraph switch, A. G. Snell ... 227,931
Telephone, S. W. Robinson ... 227,655
Telephone, electric, W. F. Cook ... 227,736
Telephone, magnet, A. G. Tiedel ... 227,861
Tether, animal, W. A. Witt ... 227,666
Thill coupling, H. Slade ... 227,850
Time detector, watchman's, A. Newman ... 227,641
Tool, combination, D. Hartman ... 227,773
Tool for grasping and holding articles, J. Goodrich ... 227,694
Torpedo boat, G. W. McMullen ... 227,697
Track gauge and level, combined, J. T. Ketchledge ... 227,791
Tray blanks, machine for cutting, J. R. Allgire ... 227,711
Truck, car, S. D. King ... 227,792
Truck, hand, M. Johnson ... 227,791
Truss, G. A. Willard ... 227,706
Tubes, forming plugs for welding, G. Matheson ... 227,685
Tug attachment, S. Courtright ... 227,738
Tweezers, spring, F. L. Ellis ... 227,680
Undergarment, C. F. Devens ... 227,624
Vapor burner, F. A. Lyman ... 227,686
Vehicle shifting seat, J. A. Chapman ... 227,612
Vehicle spring, F. J. Springer ... 227,661
Velocipede, J. A. Fancher ... 227,748
Velocipede, Gill, Jr., & Alexander ... 227,665
Wagon brake lever, J. B. Sexton ... 227,947
Washing machine, C. D. Hoffman ... 227,780
Watches, balance staff and wheel for, G. G. Buglee ... 227,726
Well boring machine, J. W. Teetzel ... 227,959
Wheel bearing, J. H. Mughes ... 227,682
Whiffletree, G. Saint ... 227,843
Winding cord or rope, guide for, M. Donnelly ... 227,743
Windmill, C. F. Rudolph ... 227,842
Wire bending machine, H. Martyn ... 227,804
Wrench, S. J. Talbot ... 227,856
Wrench, L. & A. Y. Gray ... 227,765

DESIGNS.

Bracelet, C. Helm ... 11,778
Fan, R. F. Ehle ... 11,776, 11,777
Moulding, wood, H. D. Benjamin ... 11,776
Scarf, neck, T. J. Flagg ... 11,780 to 11,784
Spoon and fork handles, G. Gill ... 11,779

TRADE MARKS.

Beverage for the table used as a substitute for coffee, Knoka Manufacturing Company ... 7,906
Beverages, tonic, Johnson & Bishop ... 7,911
Bitters, Mayer Brothers & Co. ... 7,912
Buttons, H. W. Knight ... 7,909, 7,910
Canvas paddings, J. F. White ... 7,914
Medical compounds, Relief Manuf. Company ... 7,908
Medicated lozenges or confections, F. C. Pearce ... 7,913
Medicinal preparations, E. F. Arthur ... 7,907
Shoes, C. H. Bass ... 7,915
Teas, G. Lockitt & Sons ... 7,917

English Patents Issued to Americans.

From May 18 to May 21, 1880, inclusive.

Boot and shoe sole trimmer, O. L. G. Noble, U. S. A.
Electric lamp, P. Drew, Brooklyn, N. Y.
Furnace draught regulating, H. A. Brognard, Phila., Pa.
Gas, manufacture of, J. D. Averill, New York city.
Grain grinding and purifying apparatus, G. Milbank, Chillicothe, Mo.
Grain elevating, transferring, and cleaning apparatus, W. B. Raney, Baltimore, Md.
Grain elevating, transferring, and distributing apparatus, F. A. Luckenbach, Philadelphia, Pa.
Leather, artificial, H. S. Chase, Boston, Mass.
Loom, L. J. Knowles, Mass.
Magneto-electric machine, C. A. Seeley, New York city.
Malt and hops, apparatus for drying, A. J. Reynolds, Chicago, Ill.
Padlock, W. K. McDonald et al., Calais, Me.
Stables, A. H. Crawford, Liverpool, N. Y.
Stamming apparatus, A. H. Crawford, Liverpool, N. Y.
Steel, manufacture of, A. L. Holley, Brooklyn, N. Y.

Founded by Mathew Carey, 1785.

BAIRD'S BOOKS FOR PRACTICAL MEN.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS, 96 pages, 8vo, a Catalogue of Books on DYEING, CALICO PRINTING, WEAVING, COTTON and WOOLEN MANUFACTURE, 4to; Catalogue of a choice collection of PRACTICAL, SCIENTIFIC and ECONOMIC BOOKS, 4to; List of Books on STEAM AND THE STEAM ENGINE, MECHANICS, MACHINERY, and ENGINEERING, 4to; List of Important Books on METALLURGY, METALS, STRENGTH OF MATERIALS, CHEMICAL ANALYSIS, ASSAYING, etc., 4to; List of Books on MINING, MINING MACHINERY, COAL, etc., 4to; two Catalogues of Books and Pamphlets on SOCIAL SCIENCE, POLITICAL ECONOMY, BANKS, POPULATION, PAUPERISM, and kindred subjects; a Catalogue of recent additions to our stock of PRACTICAL, SCIENTIFIC, AND TECHNICAL BOOKS, as well as a List of LEADING BOOKS ON METAL MINING, METALLURGY, MINERALOGY, ASSAYING, AND CHEMICAL ANALYSIS, sent free to any one who will forward his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, PHILADELPHIA.

XX COT (not painted, White Duck) $2.

Makes a perfect bed. No mattress or pillows required. Better than a hammock, as it fits the body as pleasantly, and lies straight. Folded or opened instantly. Self fastening. It is just the thing for hotels, offices, cottages, camp-meetings, sportsmen, etc. Good for the lawn, piazza, or "coolest place in the house." Splendid for invalids or children. Sent on receipt of price or C. O. D. For 50 cts. extra, with order, I will prepay expressage to any railroad station east of Mississippi River and north of Mason and Dixon's line. For 75 cents, in Minnesota, Missouri, and Iowa.

HERMON W. LADD, 108 Fulton St., Boston; 207 Canal St., New York; 165 North Second St., Phila.; 94 Market St., Chicago. Send for Circulars.

FIRE BRICK TILE AND CLAY RETORTS ALL SHAPES. BORGNER & O'BRIEN. ... PHILADELPHIA.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

FREE Illustrated CATALOGUE of 3 Cts. ... SONGS ... F. F. NASON, 111 Nassau St., N. Y.

KNOW THYSELF.

THE untold miseries that result from indiscretion in early life may be alleviated and cured. Those who doubt this assertion should purchase the new medical work published by the PEABODY MEDICAL INSTITUTE, Boston, entitled THE SCIENCE OF LIFE; or, SELF-PRESERVATION. Exhausted vitality, nervous and physical debility, or vitality impaired by the errors of youth or too close application to business, may be restored and manhood regained.

Two hundredth edition, revised and enlarged, just published. It is a standard medical work, the best in the English language, written by a physician of great experience, to whom was awarded a gold and jeweled medal by the National Medical Association. It contains beautiful and very expensive engravings. Three hundred pages, more than 50 valuable prescriptions for all forms of prevailing disease, the result of many years of extensive and successful practice, either one of which is worth ten times the price of the book. Bound in French cloth; price only $1, sent by mail, postpaid.

The London *Lancet* says: "No person should be without this valuable book. The author is a noble benefactor."

An illustrated sample sent to all on receipt of 6 cents for postage.

The author refers, by permission, to Hon. P. A. BISSELL, M.D., president of the National Medical Association. Address Dr. W. H. PARKER, No. 4 Bulfinch street, Boston, Mass. The author may be consulted on all diseases requiring skill and experience.

HEAL THYSELF.

HOLCOMB'S Automatic Telephone,
Patented in U. S. and Canada.
Works 1 mile, secures great clearness and volume of tone. Best in use. Price $4 per set. Illustrated circulars free.
HOLCOMB & CO., Mallet Creek, O.

USEFUL BOOKS.

Fossick's Iron Trade Chart; showing at a glance the fluctuations in prices, and amount of production of Rails, Bar and Pig-iron, etc., during the past fifty years in Great Britain. Printed in gold and colors, $1.50.

Workshop Receipts for Manufacturers, Mechanics, etc., with practical information on making various kinds of Fireworks, $2.00.

Ornamental Penman's, Engraver's, and Sign-writer's Pocket-book of Alphabets. 32 plates. 20 cents.

Steel; Its History, Manufacture, and Uses. By J. S. Jeans. Complete in one thick 8vo volume, containing 860 pages, 24 plates, and 181 engravings. $14.20.

Descriptive circulars and catalogue sent free on application.

E. & F. N. SPON, 446 Broome St., N. Y.

CARY & MOEN STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. 234 W. 29 ST. NEW YORK CITY

WE HAVE JUST PUBLISHED
A DIGEST OF
Patent Office Decisions
FROM 1869 TO 1880.

Being a Digest in classified and chronological order, of substantially all the reported Decisions of the Commissioners of Patents to January 1, 1880. By WM. E. SIMONDS, Counsellor-at-Law. Sent by mail upon receipt of price, $3.00.

W. H. & O. H. MORRISON,
LAW BOOKSELLERS & PUBLISHERS,
WASHINGTON, D. C.

NEW YORK BELTING AND PACKING COMP'Y.

Emery Wheel.

The Oldest and Largest Manufacturers of the Original
SOLID VULCANITE
EMERY WHEELS.

All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.

Address NEW YORK BELTING AND PACKING CO.,
JOHN H. CHEEVER, Treas. NEW YORK.

MECHANICS WANTED.

In consequence of the continued increase of our business we are constantly in need of good sewing machine assemblers, adjusters, tool makers, and drill, mill, and screw hands. First-class workmen, desiring permanent employment at good wages, should address for particulars, stating their qualifications, to

WILSON SEWING MACHINE CO., Chicago, Ill.

WANTED.

An experienced foreman for a machine shop, to work about 40 men on a large variety of heavy work, repairing, etc. Address W. C. & CO., Box 6, Chicago, Ill.

PATTERN MAKERS'

Beveling Scroll Saw and Turning Lathe.

Guaranteed to be the most profitable ever put into a pattern maker's shop. Will saw at any level, and leave work ready for shellacing. For gears, registers and scroll patterns will do the work of four men, and work made with it will draw 50 per ct. better than that made by hand. Invaluable for country foundries and those who would like to do work at home. All shops that once buy it. Send for catalogue. A. S. ... Rochester, N. Y.

10,000— JUST ISSUED. —Steam Users.
MILLS' DIRECTORY of BOILER OWNERS
and STEAM USERS in the
NEW ENGLAND STATES.

Arranged by city and town alphabetically. This book gives the number of Boilers used in each establishment. Business men dealing with this trade will appreciate its true value for canvassing and circular advertising. Sent C. O. D. for $3.50. THE J. N. MILLS PUBLISHING CO., 10 Pemberton Sq., Boston. 165 Broadway, New York.

AGENTS WANTED.

We want agents to sell the WORLD RENOWNED
WILSON SEWING MACHINES
in unoccupied territory. We are prepared to offer inducements that will pay from One to Six Thousand Dollars a year. For further particulars, address, stating business experience,

WILSON SEWING MACHINE COMPANY, Chicago, Ill.

J. C. MOSS, Prest. and Supt. M. A. MOSS, Treasurer. J. E. RAMSEY, Secretary.
R. B. MOSS, Ass't Supt. H. A. JACKSON, Ass't Sec'y.

THE LARGEST ESTABLISHMENT OF THE KIND IN THE WORLD.

The Moss Engraving Co.,

INCORPORATED APRIL 2, 1880.

MOSS'S NEW PROCESS,

535 PEARL STREET, COR. ELM, ONE BLOCK FROM BROADWAY.

Relief Plates for Newspapers, Book, and Catalogue Illustrations engraved in Type Metal in a superior manner by a new and improved Photo-Chemical Method, from all kinds of Prints, Pen Drawings, Photographs, Tintypes, Original Designs, Pencil Sketches, and when available, from the subject itself. Much cheaper than wood cuts. These plates are mounted type high, have a perfectly smooth printing surface, and the lines are as deep, sharp, and even as they could possibly be cut by hand; can be used on any press where type or wood cuts can be used, and can be printed on wet or dry paper. Electrotypes can be made from them in the usual manner. To facilitate our business we have an electric light of very great power, which enables us to prosecute our work in cloudy weather and to push through hurried orders in the night. We also have a fully equipped steam electrotyping department, and a large cylinder press for fine relief plate printing. **Mr. Moss in withdrawing from the Photo-Engraving Co., 67 Park Place, has retained for himself all improvements made and used by him in Photo-Engraving since May, 1872. Engraving of portraits, landscapes, and machinery of every kind for manufacturers, catalogues, inventors' circulars, scientific books, and newspapers, executed in the highest style of the art at reasonable prices.** Our Motto is, "The Best Work at Low Prices, Always on Time." Send stamp for illustrated circular. Send copy for estimate. Please mention this paper.

ALL MANUFACTURERS INTERESTED.

There is great advantage in being located close to the Sale and Jobbing Houses of NEW YORK City, the great Market and Distributing Center for the whole Country. Most excellent Manufacturing facilities are newly opened, on low terms as yet, on the City Border, with Water Frontage, etc. For Particulars, address A. J. STEVENS, 111 B'way, N. Y.

FOR SALE—ONE No. 5 VALLEY MANUfacturing Co.'s fly wheel-pump suction 5½; discharge, 5½. One No. 2 Valley Mfg. Co.'s fly wheel-pump suction, 2; discharge, 1½. Apply to PAUL A. OLIVER, basement First National Bank, Wilkesbarre, Pa.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent. greater strength, a finer finish, and is truer to gauge, than any other in use renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS,
Try Street, 2d and 3d Avenues, Pittsburg, Pa.
190 S. Canal Street, Chicago, Ill.

☞ Stocks of this shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass. Geo. Place Machinery Agency, 121 Chambers St., N. Y.

Has More Good Points. Does More and Better Work, Takes Less Power, Than any Hammer in the World.
BRADLEY & COMPANY, SYRACUSE, N. Y.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.

DAVID W. POND, Worcester, Mass.

FOR SALE. One Schenck Matcher in running order. Cost $2,000. Will sell for $500. Call on or address G. & T. ALLING & CO., 186 E. Water St., New Haven, Ct.

THE FORSTER FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

BUCKET PLUNGER STEAM PUMPS.
FOR EVERY DUTY.
VALLEY MACHINE CO.,
EASTHAMPTON, MASS.

BARNES' PATENT FOOT POWER MACHINERY.

CIRCULAR SAWS, SCROLL SAWS, LATHES, FORMERS, MORTISERS, TENONERS, &c., for actual workshop business.

COMPLETE OUTFITS for Mechanics and Amateurs.

MACHINES ON TRIAL IF DESIRED.

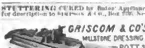
Say where you read this, and send for Descriptive Catalogue and Price List. W. F. & JOHN BARNES, Rockford, Ill.

PORTER MANUF'G CO.


The New Economizer, the only Agricultural Engine with Return Flue Boiler in use. Send for circular to Porter Mfg. Co., Limited, Syracuse, N. Y.

G. G. YOUNG, Gen. Agt., 42 Cortland St., New York.

STUTTERING CURED by Bates' Appliances. Send for description to SIMPSON & CO., Box 2236, New York.



ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.

JOHN R. WHITLEY & CO.

European Representatives of American Houses with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E. C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.

Forster's Rock & Ore Breaker and Combined Crusher and Pulverizer.

The simplest machine ever devised for the purpose.

Parties who have used it constantly for six years testify that it will do double the work of any other Crusher, with one-third the Power and one-half the expense for keeping in repair. The smaller sizes can be run with Horse Power.

Address TOTTEN & CO., Pittsburgh, Pa.

STEAM PUMPS.

HENRY R. WORTHINGTON.

239 Broadway, N. Y. 83 Water St., Boston. 709 Market St., St. Louis, Mo.

THE WORTHINGTON PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.

WORTHINGTON STEAM PUMPS of all sizes and for all purposes.

Prices below those of any other steam pump in the market.

WATER METERS. OIL METERS.

Grain Speculation

In large or small amounts. $25 or $25,000. Write W. T. SOULE & CO., Commission Merchants, 130 La Salle St., CHICAGO, ILL., for Circulars.

STEAM PUMPS.

THE NORWALK IRON WORKS CO.,
SOUTH NORWALK, CONN.

ALAND'S
Silent Injector,
Blower & Exhauster.
Apply to
S. ALAND,
Rome, Oneida Co., N. Y.

17-STOP ORGANS

Sub-bass and Oct. Coupler, box'd and ship'd only $97.75. New Pianos, $195 to $1,600. Before you buy an instrument be sure to see my Mid-summer offer, illustrated, free. Address Daniel F. Beatty, Washington, N. J.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators.
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

WANTED—FIRST-CLASS PARTIES IN cities to sell Wing's Fan Ventilators. A great success. Rare chance to make money. See Sci. Am., Jan. 31, 1880, or send for pamphlets, etc. L. J. WING, or THE SIMONDS MFG. CO., 30 Cliff Street, New York.

CAVEATS, COPYRIGHTS, LABEL REGISTRATION, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the Preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Registration of Labels, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1866, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 20, 1866, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound **Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.**

Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.

BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

Advertisements.

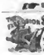
Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

ROOTS' NEW IRON BLOWER.

POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED
IS SIMPLER, AND HAS
FEWER PARTS THAN ANY OTHER BLOWER.
P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 8 Dey Street, NEW YORK.
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street,
☞ SEND FOR PRICED CATALOGUE.



$3 Printing Press

Prints cards labels &c. (Self inker $4) 18 larger sizes for business or pleasure, young or old. Do your own advertising and printing. Catalogue of presses, type, cards, &c., for 2 stamps. Kelsey & Co. Meriden, Conn.

Metallic Shingles

Make the most DURABLE and ORNAMENTAL ROOF in the world. Send for descriptive circular and new prices to

IRON CLAD MANUFACTURING CO.,
22 CLIFF STREET, New York.

WANTED—AGENTS TO SELL RIGHTS FOR A NEW and improved Churn. Apply to LESTER COOLEY, P. O. Box 1360, Binghamton, N. Y.

SPY Glasses, Field & Opera Glasses, MICROSCOPES, Magnifying Glasses. Circulars free. McALLISTER Mfg. Optician, 49 Nassau St., N. Y.

"BUCKEYE" LAWN MOWER.

The lightest and easiest running Mower ever made.
STRICTLY FIRST CLASS.
MAST, FOOS & CO., Springfield, Ohio.
Send for catalogue.

Delamater Steam Pumps,

For every variety of work.

WATERWORKS PUMPING ENGINES.
DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
Office, No. 10 CORTLANDT ST.,
Works, Foot of W. 13th St., North River, New York.
ESTABLISHED 1841.

MACHINISTS' TOOLS.

NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO., New Haven, Conn.

SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO., 331, 333, 335, & 337 West Front Street, Cincinnati, Ohio.

Pictet Artificial Ice Co., Limited,

P. O. Box 3083. 142 Greenwich St., New York.
Guaranteed to be the most efficient and economical of all existing Ice and Cold Air Machines.

New Undestructible Water Pipe.

We are now prepared to furnish Water Pipes from 1 in. upward. Cost less than cast-iron pipe. Will not rust or corrode. Guaranteed 300 pounds pressure to the square inch. Apply WROUGHT IRON ASPHALTED PIPE CO. FACTORY, 350 East 117th St., New York City.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SONS, Buffalo, N. Y.

CARNEGIE BROS & CO
UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought
STRUCTURAL IRON.
It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders, on application.

THE MACKINNON PEN OR FLUID PENCIL.

Particulars mailed Free.
MACKINNON PEN CO.,
200 Broadway, near Fulton St., N. Y.

The New York Ice Machine Company,

21 COURTLANDT STREET. ROOM 54.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more Ice. Uses only ¼ water of condensation. No Pressure at rest. Pressure in running, 14 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

THE HOLLY SYSTEM OF STEAM HEATING FOR CITIES AND VILLAGES. HOLLY STEAM COMBINATION CO. LIMITED LOCKPORT N. Y.

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements.
from 10 to 1,000 H. P.

BOILER COVERINGS.

Plastic Cement and Hair Felt, with or without the Patent "AIR SPACE" Method.
ASBESTOS MATERIALS.
Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John street, and Foot of E. 9th Street, New York.

COLUMBIA BICYCLE.
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of The Bicycling World.
THE POPE M'F'G CO., 89 Summer Street, Boston, Mass.

GENUINE BABBITT METAL,

Fine Brass and Composition Castings.
E. STEBBINS M'F'G CO., SPRINGFIELD, MASS.

A PLANING MILL OUTFIT FOR SALE very low for cash. Will sell all together or each machine separate. All first-class machines, good order.
J. H. KERRICK & CO., Indianapolis, Ind.

Wood-Working Machinery,

such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON, 26 Salisbury Street, Worcester, Mass. (Shop formerly occupied by R. BALL & CO.)

COE BRASS MFG. CO
WOLCOTTVILLE CONN.
BRASS AND COPPER IN SHEETS
MATERIALS FOR METALLIC AMMUNITION A SPECIALTY
WIRE AND BLANKS

FRIEDMANN'S PATENT INJECTOR,
The best
BOILER FEEDER
in the world.
Simple, Reliable, and Effective.
40,000 IN ACTUAL USE.
NATHAN & DREYFUS,
Sole Manufacturers, *NEW YORK.*
Send for Descriptive Catalogue.

J. STEVENS & CO.,
P. O. Box 28, Chicopee Falls, Mass.
Manufacturers of Stevens' Patent Breech-Loading Sporting and Hunters' Pet Rifles, Single and Double Barrel Shot Guns, Pocket Rifles, Pocket Shot Guns, Gallery Rifles, Superior Spring Calipers and Dividers including the New Patent Coil Spring Calipers; also Double Lip Countersinks and Hathaway's Patent Combination Gauge.

SHEET METAL DROP PRESSES.
STILES & PARKER PRESS CO., Middletown, Conn.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.

BI-SULPHIDE OF CARBON. E. R. TAYLOR, Cleveland, O.

IT PAYS to sell our Rubber Hand Printing Stamps. Circulars free. G. A. HARPER & BRO., Cleveland, O.

SPARE THE CROTON AND SAVE THE COST.
Driven or Tube Wells
furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N. Y., who control the patent for Green's American Driven Well.

GREAT LABOR SAVING TOOL.

Chase's Pipe Cutting and Threading Machine, for Steam, Gas Fitters, and Machinists, for cutting off and threading Pipes, Tubes, Round Iron, Bolts, and nuts, ¼ to 2 inches. No pipe splitting. No level inside or outside. A boy with this machine can do more work than two men with old system. Neither has automatic cut-off or makes nipples. Send for circular. Chase Machine Co., 120 Front St., N. Y.

Steel Castings

From ¼ to 15,000 lb. weight, true to pattern, of unequaled strength, toughness, and durability. 15,000 Crank Shafts and 10,000 Gear Wheels of this steel now running prove its superiority over all other Steel Castings. Send for circular and price list.
CHESTER STEEL CASTINGS CO., 407 Library St., Phila., Pa.

Shafts, Pulleys, Hangers, Etc.

Full assortment in store for immediate delivery.
WM. SELLERS & CO., 79 Liberty Street, New York.

WOOD SOLE SHOES.
The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and the classes of laborers. Send stamp for circular and price list.
CHAS. W. COPELAND, 122 Summer St., Boston, Mass.

BUY NO BOOTS OR SHOES Unless the soles are protected by Goodrich's *Hammer Heel Rivets. Guaranteed to outwear any other sole.* All dealers sell them. Tape by mail for 25 cents in stamps. Send paper pattern of size wanted. H. C. GOODRICH, 13 Church St., Worcester, Mass.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

The Rodier Patent Single Iron Plane.

Made of extra quality iron. A practical labor-saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

The Asbestos Packing Co.,

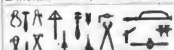
Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:
PATENTED ASBESTOS ROPE PACKING,
" " LOOSE "
" " JOURNAL "
" " WICK "
" " MILL BOARD,
" " SHEATHING PAPER,
" " FLOORING FELT,
" " CLOTH.

THE DRIVEN WELL.

Town and County privileges for making Driven Wells and selling Licenses under the established American Driven Well Patent, leased by the year to responsible parties, by
WM. D. ANDREWS & BRO., 235 BROADWAY, NEW YORK.

H. W. JOHNS' ASBESTOS

LIQUID PAINTS, ROOFING, BOILER COVERINGS, Steam Packing, Sheathings, Fireproof Coatings, Cements,
SEND FOR SAMPLES, ILLUSTRATED PAMPHLET, AND PRICE LIST.
H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.



Small Tools of all kinds; GEAR WHEELS, parts of MODELS, and materials of all kinds. Catalogues free. GOODNOW & WIGHTMAN, 176 Wash'n St., Boston, Mass.

Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

To Electro-Platers.

BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with Books of Instruction for Gold, Silver, or Nickel Plating. THOMAS HALL, Manufacturing Electrician, 19 Bromfield Street, Boston, Mass. Illustrated Catalogue sent free.

THE WATSON PUMP FOR ARTESIAN OR DEEP WELL PUMPING ... IN DIRECT LINE MACHINE SIMPLE EFFICIENT. JAMES WATSON ... S. FRONT ST. PHILA.

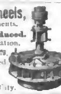
No Sawdust! No Planing!

This lumber, 1-16 to ½ inch thick, cut and seasoned by our recently patented machines, equal if not superior to the sawed and planed wood, being smooth, flat, and in all cases perfectly seasoned. Used by the largest manufacturers in the country, and giving entire satisfaction. In addition to our specialty, our usual complete stock of sawed Hardwood, Lumber, and Veneers, figured and plain, Burls, etc.

GEO. W. READ & CO.,
186 to 200 Lewis Street, New York.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.



Leffel Water Wheels,
With recent improvements.
Prices Greatly Reduced.
8000 in successful operation.
FINE NEW PAMPHLET FOR 1879,
Sent free to those interested.
James Leffel & Co.,
Springfield, O.
110 Liberty St., N. Y. City.

MACHINISTS' TOOLS.
Iron Planing Machines

A SPECIALTY.
C. WHITCOMB & CO., Worcester, Mass.

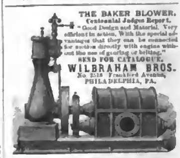
THE TANITE CO.,

STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ICE-HOUSE AND REFRIGERATOR.—Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of 34° to 38°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 116. Price 10 cents. To be had at this office and of all newsdealers.

OUR CATALOGUES, illustrated and priced, of Microscopes, Telescopes, Opera and Field Glasses, Thermometers, Barometers, mailed free to any address. R. & J. BECK, Manufacturing Opticians, Philadelphia, Pa.

TELEGRAPH and Electrical Supplies. Send for Catalogue. C. E. JONES & BRO., CINCINNATI, O.



THE BAKER BLOWER.
Centennial Judges Report.
"Good Design and Material. Very efficient in action, With the special advantages that they can be connected for suction directly with engine without the use of gearing or belting."
SEND FOR CATALOGUE.
WILBRAHAM BROS.
No. 2318 Frankford Avenue,
PHILADELPHIA, PA.

Holly's Improved Water Works.

Direct Pumping Plan. Advantages: 1. Secures by variable pressure a more reliable water supply for all purposes. 2. Less cost for construction. 3. Less cost for maintenance. 4. Less cost for daily supply for all use of Holly's Improved Pumping Machinery. 5. Affords the best fire protection in the world. 6. Largely reduces insurance risks and premiums. 7. Dispenses with fire engines, in whole or in part. 8. Reduces fire department expenses. For information, address the HOLLY MANUFACTURING CO., Lockport, N. Y., Or PARK BENJAMIN & BRO., Gen. Agents, 8 and 10 Astor House, N. Y. City.

BROWN'S PAT. SPLIT PULLEYS
Shafts, Hangers.
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

PROSPECTUS
OF THE
Scientific American
FOR 1880.

The Most Popular Scientific Paper in the World.

VOLUME XLII. NEW SERIES.

Only $3.20 a Year, including postage. Weekly.
52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for one year—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of three dollars and twenty cents by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of seven dollars by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N.Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLII.—No. 26.] [NEW SERIES.] NEW YORK, JUNE 26, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

AMERICAN INDUSTRIES.—No. 47.

THE MANUFACTURE OF DYNAMO-ELECTRIC MACHINES AND ELECTRIC LAMPS.

The Weston machine for electro-deposition of copper, silver, nickel, and gold is too well known to need any description here. Nearly all the large electroplating and electrotyping establishments in this country use them. They are also extensively used in England, France, Belgium, and are found in use in nearly all parts of the civilized world. A large machine of this kind was recently built for the Italian Government for the deposition of copper.

The light machine shown in our engraving, although largely used in this country, is not so well known. It has been designed and constructed strictly in accordance with scientific principles, the utmost care having been taken to avoid loss of energy in the machine itself. The armature is built up of a series of thin perforated iron disks, which are firmly secured to the shaft by means of two nuts. Between the disks there are spaces of about one-eighth of an inch. At the end of the armature there is a tube surrounding the shaft, but larger in diameter than the shaft, and terminating at one end in a flange nearly equal in diameter to the armature disks. Each end of the armature consists of a large iron disk, having ribs on its periphery extending from one side of and parallel with the shaft. In the end of this thick disk a deep circular groove is cut, and a number of holes are bored through it parallel with the shaft. When the flanged tube is pushed over the shaft and fixed to the end of this thick disk the deep groove forms a chamber.

In the periphery of the thin disks a number of grooves are cut, so that when the disks are placed side by side on the shaft these spaces are in line, thus forming grooves extending the whole length of the armature. The wire is wound in these grooves on both sides of the armature and parallel with the shaft. The wire is wound in a manner somewhat similar to that adopted by Siemens, and the armature when covered with the wire is perfectly cylindrical.

Quite an important feature in this machine is the means adopted to keep the coils and other parts of the machine as cool as possible. This is accomplished in the armature by making the armature perform the function of an ordinary blower. The flanged tubes which envelope the shaft extend beyond the ends of the coils; and thus leave an opening at the ends near the center of the armature through which air may enter and pass into the chamber between the thick iron disks forming the ends and the flange of the tubes, and from these through the holes in the end disks into the perforated sheet iron disks, and thus pass between them and escape through the spaces between the disks on the periphery of the armature. In order to increase the circulation, air-vanes extend through these iron disks from end to end of the armature. The ends and poles of the magnets are also perforated in order to allow the air to circulate through them and cool them.

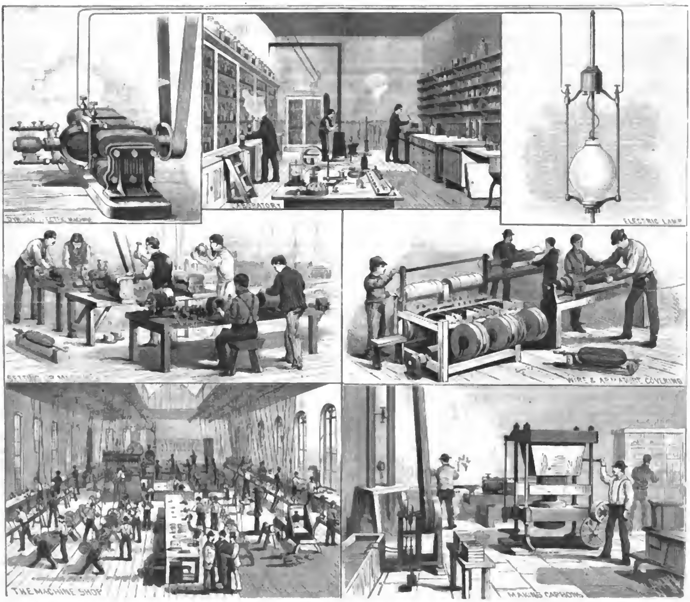
The report of Professor Morton to the American Lighthouse Board shows the remarkable performance of this machine. The machines entered at this competitive test were the Siemens, Brush, Maxim, Wallace, Hockhausen, and Weston. The Weston machine greatly excelled all others. It gave nearly double the light per horse power, when compared with the Siemens.

The lamp manufactured by this company for the purposes of general illumination is shown in one of the views in the engraving. It is remarkable for its simplicity and the excellence of its performance. At present twenty-five of these can be run on a single circuit by the current from one machine; and Mr. Weston hopes soon to be able to double this number. Mr. Weston has spent much time and devised many ingenious plans for working a large number of lamps on one circuit. Several hundred of these lamps are now in constant use in factories, hotels, stores, steamboats, etc.

The Weston Electric Light Company are also building machines for the transmission of power by electricity, machines for telegraphy, etc. The works are run night and day, and use the electric light exclusively for lighting the factory.

The engraving shows several of the departments of the

[Continued on page 405.]



THE MANUFACTURE OF DYNAMO-ELECTRIC MACHINES AND ELECTRIC LAMPS.—THE WESTON ELECTRIC LIGHT CO., NEWARK, N. J.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, SATURDAY, JUNE 26, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 234,

For the Week ending June 26, 1880.

Price 10 cents. For sale by all newsdealers.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The Twelfth Annual Convention of this society was held at St. Louis, Mo., May 25 to 28. Mr. Albert Fink, the president, not being in attendance, Captain James B. Eads was elected chairman. There were present a large number of members and visitors, including leading engineers from all sections of the country. The programme included daily sessions for the reading of papers and the discussion of topics of interest in the engineering profession, together with excursions to allow of the inspection of notable engineering works in St. Louis and its vicinity.

Among the visits made, one was to the St. Charles Bridge over the Missouri, for which a new span of 312 feet length was completed the 1st of April last. The floor of the bridge is of iron beams, thirty inches deep; on each side of the rail is an iron trough, ten inches wide and five inches deep, and outside of this is a timber guard, 12x12 inches, all to prevent damage to the trusses by derailment. Another visit to the St. Louis Water Works was of great interest to the attending engineers. To supply St. Louis the turbid waters of the Mississippi are pumped into four receiving basins, each 600 feet long by 270 feet wide, and about 16 feet deep, where the water is allowed to remain until the sediment settles, which it does at the rate of about one inch of deposit per week. It takes about a week for the water to become clear, when it is supplied to consumers, the high service being supplied from a reservoir into which the water is pumped by four large engines. The deposit in the settling basins is loosened by hard labor and washed out by a powerful stream of water. At the Vulcan Steel Works, in South St. Louis, an inspection was made of an establishment at present capable of turning out 200 tons of steel rails per day, and the furnaces of the Meier Iron Co., operated by the Missouri Furnace Company, were also visited. The latter are in Illinois, opposite Carondelet, and are making an average production of 160 tons of Bessemer pig iron per day.

Among the papers presented to the convention, one was on "The Hudson River Tunnel," by Charles B. Brush, of Spielman & Brush, the engineers in charge of that work, who furnished the plans from which our illustrations of the tunnel were made in the SCIENTIFIC AMERICAN and SUPPLEMENT a few weeks since. The subject of another paper, by O. F. Nichols, was "Peruvian Tunnels." Two papers were read upon cements, a subject which raised considerable discussion. One was by D. J. Whittemore, on "Tensile Tests of Cements, and an Appliance for more Accurate Determination," with illustrations and diagrams giving the results of numerous experiments, and another was by F. O. Norton, on "American Cements." Mr. Whittemore showed that American hydraulic cements varied twenty per cent in weight, and he conceived it possible that in some cases the surfaces of specimens acquired a tenacity not extending throughout the entire mass, and that "a surface hardening had taken place, through some process of crystallization, or by the absorption of carbonic acid, forming subcarbonates." Mr. Norton said that from 1,000,000 to 1,500,000 barrels of Rosendale cement were made each season, and that "when a small amount of water is used in mixing the cement it gives a greater tensile strength than when the dry mixture is used, but only for a period of three months—after that the reverse is true." The discussion on this subject was participated in by Messrs. Francis, Harlow, Schmidt, Norton, Chesbrough, Whittemore, and Hutton, and quite pertinent thereto, but which, from the report of the proceedings, does not appear to have been referred to, is the recent announcement from England of the successful employment of blast furnace slag in making an excellent hydraulic cement. This hitherto waste product has there been made into a cement, which in three days is said to have been stronger than Portland cement at seven days; in seven days it was stronger than Portland cement at three months; in fifteen days it was stronger than Portland cement at three months, and in twenty-eight days it was stronger than Portland cement at seven years. This result, says *Engineering*, was obtained "by mixing the slag sand supplied by the Tees Iron Company with the white chalk of Essex, in the proportion of about one ton of slag sand to one and three fourths tons of chalk, and subsequently burning the same in an ordinary cement kiln."

Papers were presented on several other subjects, including "Web Stains in Simple Trusses," by E. Sweet, Jr., and "Ultimate Crippling Strength of Wrought Iron Columns," by C. L. Gates, all of which will appear in the published reports of the transactions of the society; but general regret was expressed that there was no report from the Committee on Iron and Steel, on account of the absence in Europe of General William Sooy Smith, its chairman, and it was hoped that every member of the Convention would use his influence to bring about a restoration of the Board for Testing Iron and Steel, a result which not only engineers, but every one engaged in any department of mechanical industry, should endeavor to promote.

A NEW PLAN FOR SMALL REMITTANCES.

The satisfaction with which the withdrawal of fractional currency in paper was greeted, a few years ago, was measurably tempered by regrets for the loss of a convenient means for remitting small sums. For such purposes coin is not at all suitable, and postal orders are at once inconvenient and relatively very costly for small amounts. Postage stamps of the larger denominations might answer the purpose imperfectly if they were exchangeable for stamps of smaller value, as it is this method of remitting usually subjects the receiver to inconvenience, if not actual loss, since few people can make use of the larger stamps in any considerable quantity. Several more or less clever devices for overcoming the difficulty have been suggested by correspondents of this paper, but none seem to have received the approbation of the postal authorities. Possibly something more may come from the plan proposed by Mr. Chetwynd, receiver and accountant general to the British post office. It appears from a late report of the postal department that a large part of the 17,000,000 money orders issued in the year ending March, 1879, were issued for sums for which commission was less than three pence; and on all such orders there was an absolute loss to the department, thus compelling a readjustment of the rates. With the withdrawal of the lower rates the money order ceased to be economical to remitters of small sums, and some other cheap and convenient remitting service was urgently called for.

Accordingly Mr. Chetwynd, who for more than forty years has taken a prominent part in the improvement of the postal service, and is particularly known as the author and joint organizer of the system of government savings banks so successful in England, has suggested a system of post office notes. As described by the author of the system, the new note is designed to combine the simplicity of a postage stamp as the subject of an account with the advantages of a small bank post bill, a circular note, and a check issued by what may be called a government bank, and payable at any one of the five thousand Government banks throughout the United Kingdom to the order of any person named by the purchaser of the note in writing on the back of it.

To begin with, it is proposed to issue four classes of these notes—namely, for 2s. 6d., 5s., 10s., and 20s.—at 1d. commission for the former two, and 2d. the latter two amounts, and it is the intention of the post office to issue them in books for use as required, as well as singly.

These notes will differ in character from our abandoned postal or fractional currency in several particulars. They will not be legal tender, and will be limited in their period of currency. Besides, though in the first instance an open note payable to the bearer on demand, a note may be crossed at once, giving it the security of a check similarly dealt with, or it may be localized in the same manner as the money order by the simple insertion of a particular post office, at which alone it will then be payable; while the mention of the payee's name adds further security to the note. But, whether open or otherwise, the postal note will require to be indorsed by the bearer before it will be cashed, so that any fraudulent attempt to get payment of it will thus involve forgery, and be subject to heavy penalties.

A bill to introduce this system was brought before Parliament just before the recent dissolution; and the scheme will doubtless be brought up again at an early date.

THE PROPORTION OF PATENTS TO POPULATION.

One of the most interesting subjects connected with the growth and development of manufactures in various parts of the country is presented in the yearly reports of the Commissioner of Patents, where the number of patents granted to each State yearly, and the proportion they bear to the population of the State, are presented in tabular form. It is only a few years since that the Patent Office began to issue any large number of patents to the Western States, Massachusetts and Connecticut and New York and Pennsylvania, as being the principal seats of manufacturing industries, standing far ahead in this matter. It is of the last importance, however, in making comparisons of this kind that we proceed from correct data as to the actual population. For the past ten years the growth of the country has been wonderfully rapid, and yet the population as given by the census of 1870 is made the basis on which the Commissioner of Patents figures out the proportionate number of patents to the total population of each State. New York State, for instance, for 1879 was credited with 2,356 patents, which was given as one for every 1,717 inhabitants. Now it is probable that the population of the State by the census being taken this year will show an increase possibly as large as one million. This, of course, would materially change the proportions thus given, and from this kind of reasoning from deficient data, the proportion of patents to population has, for most of the last ten years, been made to appear larger in nearly all of the States than it actually has been.

CYPRIEN M. TESSIE DU MOTAY.

Mons. C. M. Tessié Du Motay, chemist and inventor, of Paris, France, died in this city, June 4, at the age of sixty-five.

Mons. Du Motay was born in Brittany, France, in 1815. At an early age he went to Paris, and after achieving considerable distinction in literature, he turned his attention to science and invention. His earlier successes were in connection with chemistry. While studying that science in Germany he invented and patented several improvements in the art of bleaching and dyeing, which brought him money as well as reputation. On his return to Paris he became distinguished as a consulting chemist and metallurgist. He invented a method of manufacturing ferromanganese, and introduced notable improvements in the manufacture of glass, in the treatment of beet sugar, in photographic chemistry, and in other departments of technology. He was one of the first experimenters in electric lighting with Jablochkoff, Moncel, and Jamin, and in connection with Maregnac he in-

vented a process of producing oxygen cheaply for industrial purposes, and applied it in the manufacture of illuminating gas. At the time of his death he was engaged in introducing his system of gas making for the Municipal Gaslight Company of this city. During his residence here he has patented improved processes in mining and metallurgy; and in connection with M. Rosé, he developed last year the binary absorption system of ice making, illustrated in this paper February 21.

THE ARMY WORM.

This dreaded foe to grass and small grains has lately been doing very considerable damage along parts of the sea coast from Virginia to Long Island, and may be expected to appear in the New England States as the season advances. Accounts of its ravages are more particularly numerous in Delaware and on Long Island. The *Herald* of the 3d inst. has a long account of its injuries to rye.

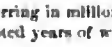
This is one of the insects that, on account of wide-spread injuries at irregular intervals, and of its not being noticed by farmers during the intervening years, attracts more than usual attention, and, notwithstanding it had been written about by economic entomologists for many years, and especially since 1861, when we had a wide-spread visitation of it, yet its full natural history was first made known some four years ago by Prof. Riley, who published a complete account of it in his Eighth and Ninth Reports on the Insects of Missouri.

Full grown Army Worm.

Various caterpillars that, from excessive multiplication, occasionally move from field to field in large bodies, have been popularly called army worms, but the term belongs to this insect *par excellence*. Up to the year 1861 very little but that was inaccurate and confusing had been written about this insect, though it is referred to in Flint's Second Report on the Agriculture of Massachusetts, as occurring in millions as long ago as 1743. 1861 and 1873 were noted years of wide-spread injury.

WHERE THE EGGS ARE LAID.

The favorite place to which the female consigns her eggs is along the inner base of the terminal blades of grasses, where such blades are yet double, and on both the green and dry blades. In fact the dry blades are preferred, and occasionally the eggs are thrust in between the sheath and stalk. The female, says Prof. Riley, having once commenced to lay, is extremely active and busy, especially during warm nights, and but two or three days are required to empty the ovaries, which have a uniform development. A string of fifteen or twenty eggs is placed in position in two or three minutes, and by the end of ten more, the moth will choose another leaf and supply it with another string. The moth perishes within a day after having exhausted her supply of eggs. The egg is glistening white when first laid, and only becomes tarnished or faintly dull yellowish toward maturity.



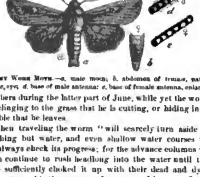
Chrysalis of Army Worm.

HABITS OF THE WORM.

As Prof. Riley well observes, the fact cannot be too strongly impressed on the mind, that the traveling of the worms in large armies is abnormal. During the latter part of April and throughout the month of May, in this part of the country, the worms may almost always be found by diligent search in moist grass land that was not cut or grazed too closely the previous autumn. At these times they have essentially the habits of ordinary cut-worms, and are seldom noticed unless so abundant as to cut the grass entirely down and be obliged to travel to fresh pastures. Indeed, one may pass daily through a grass plat where they abound, and never suspect their presence until the plat suddenly begins to look bare in patches.

The reasons why they so easily escape detection in this their normal condition is that, when less than half an inch long, the worms are scarcely recognizable as army worms, the characteristic dark, sinuous lines on the head being at this time obsolete, and the general color being pale green. The color is very variable at any stage of growth, and in some individuals the brown predominates while they are yet quite small; but up to the last moult the green generally prevails and the longitudinal dark lines are less conspicuous. The broad stigmatal line is the most persistent, being distinguished when the insect is one quarter inch long. The worms in this their normal condition feed mostly at night, and hide during the day at the base of the grass or under any other shelter at hand. If they venture to mount a plant and feed during the day—which they often do in cloudy weather—they drop at the least disturbance, and curl up in a spiral so as to simulate very closely a small shell of the *Helix* form. The worm loves cool, moist places, and is more often found around the margins of creeks and ponds than elsewhere. Last year, when the rains were so copious as to fill creeks and bottom lands and float numbers of the worms away, I saw many a one cling tenaciously to grass blades and continue feeding as though little concerned, even when partly immersed.

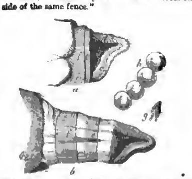
It is only when hunger impels them that they march forth from the fields where they were born, though after they have once begun the wandering habit they often pass through fields without eating everything to the ground. Invariably when the older individuals are attracting attention by congregating and traveling in armies, others may be found of all sizes in the more normal and quiet condition in grass that is yet sufficiently rank; they may indeed be found some time after the first worms have changed into moths; and the mower with his scythe often startles the moths in



ARMY WORM MOTH.—*a*, male moth; *b*, abdomen of female, natural size; *c*, eye; *d*, base of male antenna; *e*, base of female antenna, enlarged.

numbers during the latter part of June, while yet the worms are clinging to the grass that he is cutting, or hiding in the stubble that he leaves.

When traveling the worm "will scarcely turn aside for anything but water, and even shallow water courses will not always check its progress; for the advance columns will often continue to rush headlong into the water until they have sufficiently choked it up with their dead and dying bodies, to enable the rear guard to cross safely over. I have noticed that after crossing a bare field or bare road, where they were subjected to the sun's rays, they would congregate in immense numbers under the first shade they reached. In one instance I recollect their collecting and covering the ground five or six deep all along the shady side of a fence for about a mile, while scarcely one was seen to cross on the sunny side of the same fence."



ARMY WORM MOTH.—*a*, end of abdomen denuded and showing ovipositor at rest; *b*, same with ovipositor fully extended; *e*, *f*, retractile subjoints; *h*, eggs, all enlarged; *g*, eggs, natural size.

Though when hard pushed the worms will fall upon and devour each other, and will even feed upon some kind of vegetable, yet their attacks are mostly confined to the grasses and cereals, and their most natural food plants are the rank swamp grasses.

While in the more Northern States there is but one annual generation, there are at least two farther South. The insect hibernates in the perfect moth state, and is very frequently captured during mild weather of winter, especially in the Southern States. There is good reason to believe that it may exceptionally hibernate underground as a chrysalis.

GENITALIA OF MALE ARMY WORM MOTH.—*A*, end of body, denuded of hairs, showing the upper clasps protruding, and the natural position of the hidden organs by dotted lines; *B*, the organs extended.

The worm has numerous natural enemies, which pursue it remorselessly whenever it becomes unusually numerous, so that it very rarely, if ever, appears in destructive numbers for two years in succession.

REMEDIES.

Experience has well established the fact that burning over a meadow, or prairie, or field of stoppel, either in winter or spring, effectually prevents the worms from originating in such meadow or field. Such burning destroys the previous year's stalks and blades, and, as a consequence of what we have already stated, the eggs which the female moth prefers. Burning as a preventive, however, loses much of its practical importance unless it is pursued annually, because of the irregularity in the appearance of the worm and the difficulty of anticipating its coming. Judicious ditching, *i. e.*, a ditch with the side toward the field to be protected perpendicular or sloping under, will protect a field from invasion from some other infested region when the worms are marching. When they are collected in the ditch they may be destroyed either by covering them up with earth that is pressed upon them, by burning straw over them, or by pouring a little coal oil in the ditch. A simple plow furrow, six or eight inches deep, and kept friable by dragging brush in it, has also been known to head them off.

We conclude with the following summary of the natural history of this worm, given by Prof. Riley in an essay which obtained the Walker prize of the Boston Society of Natural History in 1877:

"The insect is with us every year. In ordinary seasons, when it is not excessively numerous, it is seldom noticed: First, because the moths are low, swift fliers, and nocturnal in habit; second, because the worms, when young, have protective coloring, and, when mature, hide during the day at the base of meadows. In years of great abundance the worms are generally unnoticed during early life, and attract attention only when, from crowding too much on each other, or from having exhausted the food supply in the fields in which they hatched, they are forced, from necessity, to migrate to fresh pastures in great bodies. The earliest attain full growth and commence to travel in armies, to devastate our fields, and to attract attention, about the time that winter wheat is in the milk—this period being two months later in Maine than in Southern Missouri; and they soon afterwards descend into the ground, and thus suddenly disappear, to issue again two or three weeks later as moths. In the latitude of St. Louis the bulk of these moths lay eggs, from which are produced a second generation of worms, which become moths again late in July or early in August. Exceptionally a third generation of worms may be produced from these. Further North there is but one generation annually. The moths hibernate, and oviposit soon after vegetation starts in spring. The chrysalides may also hibernate, and probably do so to a large extent in the more Northern States. The eggs are inserted between the sheath and stalk, or secreted in the folds of a blade; and mature and perennial grasses are preferred for this purpose. The worms abound in wet springs preceded by one or more very dry years. They are preyed upon by numerous enemies, which so effectually check their increase, whenever they unusually abound, that the second brood, when it occurs, is seldom noticed; and two great army worm years have never followed each other, and are not likely to do so. They may be prevented from invading a field by judicious ditching; and the burning over of a field, in winter or early spring, effectually prevents their hatching in such a field."

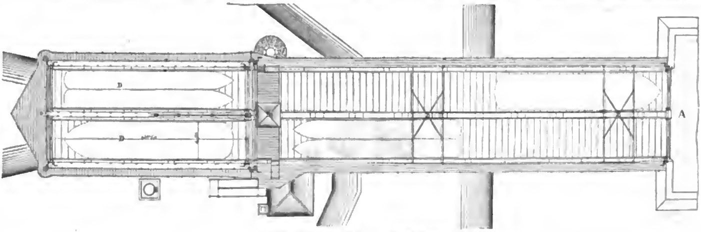
The Army Worm.

One notable feature of the present invasion is the origin of the swarms along the shores of the Sound and the ocean. For seven or eight years they have prevailed sparingly on the southeastern side of Long Island and probably elsewhere. For some favorable cause they have multiplied amazingly during the recent dry weather, and now they threaten to overrun not only all of Long Island, but also the shore counties of New Jersey and Connecticut. The invasion began about the first of June, on the farm of J. N. Plumb, near Islip, L. I., where a large area of young corn, rye, and wheat was soon destroyed. The corn was eaten off close to the ground. In the grain fields the worms crawled up the stalks and ate off the green leaves one by one, beginning at the outer end of the leaf on the under side and eating back to the stalk. Then the head was attacked, the worm nipping off the tip of each kernel and sucking out the juice. Grass, oats, clover, garden crops, and all succulent vegetation are taken as they come, the country ravaged being left brown and bare. A reporter on Long Island says: What was fresh green grass a week ago seems to the eye to have been burned by a drought. The ground is as brown as burnt sienna. The pedestrian walks on the roadside and feels the insects crush under his boots. When the sun's rays strike the worms they are, as if at a signal, at once on foot in brown masses that cover the ground. They cross the whitish road, and its dust is hidden. A carriage passes, and the wheels become as thickly incrusted with the slaughtered insects as they are with mud after a soaking rain has softened the roads. The worms crawl upon the fences and pass on exploring expeditions.

The movement of the worms in one corner of Mr. Johnson's field could distinctly be heard by leaning on the fence near by. The worms were in some rank blue grass. The column began at the fence, and almost in a straight line stretched out into the field. The march was rapid, and the grass was cut to the ground, which was covered already with multitudes pressing on behind. The sound was like the rustling of grass in a wind, only it was more continuous.

Many devices have been tried to stop the march of the pests. Some small grain fields have been in a measure protected by drawing back and forth across the grain long ropes to brush or jar the worms from the leaves and heads. Fire and boiling water have been resorted to with slight success. Ditches have been dug or plowed around threatened fields, but unless they are very deep, or the worms are constantly raked out or burned out with fire, they are soon filled up with worms, and the rest of the army goes on to complete the work of destruction.

Thus far on Long Island, the worms have ravaged a belt about two miles wide all along both shores, and are rapidly marching inland. They have just begun their march in Connecticut, while in New Jersey the coast line is suffering as severely as the Long Island shores.



PLAN OF HYDRAULIC ELEVATOR.

MECHANICAL INVENTIONS.

Dry Copying Process.—After a somewhat lengthy litigation before the United States Patent Office, to determine the originator of the invention for producing multiple copies of writing, by what is known as the dry process, two patents have lately issued, which seem to vest in a German subject the authorship of the invention. The process has been so often described in this and other papers, we will not repeat the formula; but parties desiring to use the invention will gain all information by addressing the Hektograph Company, of this city. Copies of the patents may be had at the office of this paper at the usual charge.

Mr. George Lettenmyer, of Little Georgetown, W. Va., has patented an improved carpenter's work bench. This is an improvement in the class of work benches which are provided with a sliding dog or clamping jaw operated by a lever.

Messrs. William A. Branch and Edmond Golucke, of Crawfordville, Ga., have patented improvements in grinding mills of that form in which the runner-stone is provided with metal grinding surfaces arranged in the eye of the stone, so as to give a preliminary grinding to the grain near the center, where the leverage is greater, before being admitted between the stones.

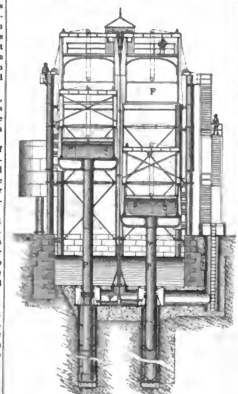
An improved roll for forming billets from steel railroad rails has been patented by Mr. Frank B. Davis, of Johnstown, Pa. The invention consists in constructing the rolls with a series of grooves, so formed as to gradually lower and thicken the web and fill out the angles between the web and the flanges and head, and then bring the rail into the form of two triangular parts connected by a thin web, and separate the two parts, forming two triangular billets.

An improved rotary pump has been patented by Mr. Erwin B. Newcomb, of Cumberland Mills, Me. The object of this invention is to construct a rotary pump in such a manner that the floats shall be balanced and operated by the pressure of the water acting through ports or channels formed in the cylinder heads, and communicating with the exit and entrance ports of the pump and with the radial float slots of the revolving cylinder.

An improved rock drill has been patented by Mr. George P. Schaurer, of Nashville, Tenn. The object of this invention is to provide a drill that will cut a perfect channel in the rock, and at the same time dress both faces of the said channel.

HYDRAULIC ELEVATOR FOR CANAL BOATS.

One of the serious defects of canal transportation is the loss in time caused by locking a boat from one level to



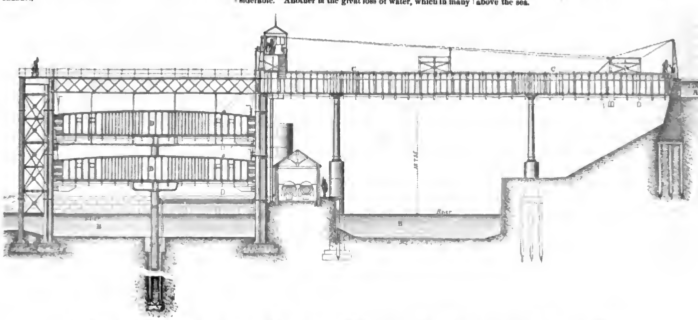
TRANSVERSE SECTION.

another, especially if the height between the levels is considerable. Another is the great loss of water, which in many cases is a factor of the greatest importance. These and like difficulties have been overcome by means of a hydraulic elevator for canal boats, constructed by the engineers, Messrs. Edwin Clark & Sidengham Duer, in the Weaver, at Auderton.

The annexed engraving, which we take from the *Annales des Travaux Public*, is an excellent representation of this elevator. The upper canal, A, is conducted directly over the lower canal, B, by means of a wrought iron aqueduct, C C, supported by iron columns, and provided with gates at the ends. The car or carriage, D, consists of an iron caisson, provided with iron sluice gates, and is centrally supported on a large iron casting, forming the upper extremity of the cast iron plunger, P, of a hydraulic elevator. This plunger passes into an iron cylinder, E, placed in the bottom of the lower canal, B, and is in communication with an Armstrong accumulator. The caisson is 80 feet long, 14½ feet wide, and the water in it is never permitted to rise higher than 5½ feet.

The total weight of the caisson and the water contained in it is about 250 tons. The diameter of the piston is 35¾ inches, and the height between the levels of the two canals is 50 feet 2 inches. The time and power required are greatly diminished by the use of two elevators. One large or two small boats are floated into each caisson, one of which is on a level with the upper canal, and the other on a level with the lower canal. The gates, F F, are then closed, and the level of the water in the upper caisson is raised about 6 inches. The valve, V, is now opened, placing the two cylinders in communication with each other. The upper caisson will now descend and the lower one will rise until the bottom of the lower one has arrived at the level of the lower canal, upon which the communication valve, V, is closed, and the valve admitting water under pressure, from the accumulator into the cylinder of the rising piston, is opened, and the rising caisson is raised to the level of the upper canal. The discharge valve of the cylinder of the descending piston is then opened, permitting the corresponding caisson to descend entirely into the lower canal, when the boats are floated out of the caissons.

A correspondent, writing from near Leadville, Col., under date of June 1st, says they have just had a fall of eight inches of snow. He lives at a place 11,500 feet high above the sea.



HYDRAULIC ELEVATOR FOR CANAL BOATS.—CONSTRUCTED IN THE WEAVER AT AUDERTON, ENGLAND.

IMPROVED STYLOGRAPHIC PEN.

For over two years fountain pens or ink pencils have been sold in this and other countries, and thousands have found them to be a very useful instrument. During this time many defects have been noticed and efforts made to overcome them, resulting at last in the production of the newest and latest pen of this kind, which was patented March 9, 1880.

The pen consists of an ink holder of vulcanized rubber, ornamented and beautifully mounted. The ink is conveyed by capillary attraction to the tubular point, containing a solid iridium-pointed needle. It combines all the advantages of pencil and pen, and is a great saver of both time and patience.

Fig. 1 shows the pen complete in its new form. Fig. 2 represents the point section removed ready for filling. Fig. 3 shows the new and late improvements, the duplex, interchangeable point section. The advantages of these improvements are at once apparent. If by any accident the pen point should break down, a new one could be obtained at a small cost. Two points can be had with each pen for fine and coarse writing. The needle by being detached from the air tube, D, cannot become bent or broken while filling the pen, but is always protected by the section, B. The new pen has the delicate spring on the end of the needle completely covered, thus effectually preventing oxidation, a source of constant annoyance in those of earlier make.

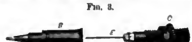
Further information may be obtained from the Stylographic Pen Company, office No. 169 Broadway, Room 18, New York.

FIG. 1.

FIG. 2.

NEW STYLOGRAPHIC PEN.

FIG. 3.



VENTILATION OF BOOTS AND SHOES.

It is a matter of the most common every-day experience that in the wearing of boots and shoes, and especially those made of rubber, the feet sweat and heat almost continually in cold weather, making the feet clammy and cold, and inducing chilblains, and in warm weather, with the best precaution, exceedingly noxious. It is doubtless the cause of much of the rotting and breaking of uppers, and is, above all, an exceedingly unhealthy feature of the present method of dressing the feet. Attempts have heretofore been made to obviate this in a number of ways, for instance by inner soles of different kinds intended to absorb the moisture; and unsuccessful efforts have also been made to ventilate the boot or shoe. Every person feels the need of something that will satisfactorily accomplish this object. The accompanying engraving illustrates a recent invention which does this effectually, and is an exceedingly simple device. It consists of a spiral coiled brass wire, laid in a groove extending in and around the under side of the insole of the boot or shoe, with holes punched at close intervals, immediately over the coil. The coil is extended along to the heel, and carried to the top, where it stops at an eyelet hole, forming, when walking, a complete automatic air pump, continually drawing in pure air and throwing off the foul and heated air.

BOOT AND SHOE VENTILATOR.

The inventor states that the invention stands a practical test, successfully ventilating a boot or shoe, and it is an especial benefit to rubber goods, which, as at present worn, are peculiarly destructive to the feet. Its application is inexpensive and will not materially increase the price, and it is claimed that its use will be economical, as it prevents the breaking of the uppers where they join the sole.

There can be no question that the unhealthy condition of the feet induces many of the diseases and ailments with which we are afflicted, and the sanitary and health preserving features of the invention are among the first that recommend it to universal use. It insures economy, personal comfort, and health above all, and will undoubtedly become an article of every-day wear as soon as it is properly presented to the public. We learn that contracts are now being made with large manufacturers to introduce it in their goods. It was invented and patented by D. A. McDonald, a practical shoemaker, and is now owned and controlled by the McDonald Boot and Shoe Ventilating Company, of Rockland, Me.

A Glycerine Barometer.

A glycerine barometer has been suggested by James B. Jordan, of London, and is being tested at Kew. The cistern is a cylindrical vessel of copper lined with tin, five inches deep and ten inches in diameter, fitted with a screwed cover, the air having access through a small hole in the cup attached to the cover, which has a recess holding cotton wool for filtering out the dust. The main tube, twenty-seven feet long, is connected with the cistern by attachment (with a soldered joint) to a projecting piece of tube which enters the cistern through the bottom, and is fitted at its opening with a screwed plug. The tube is an ordinary piece of metal gas pipe five eighths inch in diameter, furnished at the top with a gun-metal socket, into which is cemented a glass tube four feet long, with an inside diameter of one inch, terminating in an open cup, and fitted with an India-rubber stopper.

The fluctuations of the level of the column of glycerine are observed and read off on brass scales placed on either side of the tube, and fitted with indices and verniers moved by mill heads at the bottom of the scales. One of these scales gives the length of the column of glycerine, the other the corresponding length of a column of mercury. A variation of a tenth of an inch in a mercurial column is shown by a change of more than an inch in the glycerine column, and the latter is therefore expected to show minute variations which are imperceptible in the former. Glycerine absorbs moisture freely when exposed to the air, but this is prevented in the new barometer by covering the exposed surface in the cistern with a layer of heavy petroleum oil specially prepared.

Arsenical Poisoning.

A recent number of the *Neue Freie Presse*, of Vienna, gives, on the authority of the *Berliner Börsen Courier*, the following account of arsenical poisoning through a dress: A certain Commerzienrath L—— brought home for his daughter from a well known Parisian *atelier* a splendid dark-green dress trimmed with light-green leaves. The dress was frequently worn, but, after a time, the lady, who had a very beautiful complexion, remarked an outbreak of pustules on her neck and arms, which was especially painful at night. For a long time she concealed her state from her parents and the family physician, but after applying in vain all kinds of domestic remedies, she could no longer keep the matter secret, as she had become much worse. The family doctor at once recognized the effect of arsenical poisoning, and on chemical examination detected a large percentage of arsenic in the material of the dress.

Spontaneous Combustion.

Some experiments made at Riga with reference to the spontaneous combustion of various materials, wadding, raw flax, hemp, the waste of silk, wool, and cotton spinning, also sponge, as well as the wood dust found in the cabinetmakers' shops, appear to demonstrate the important fact, among others, that small quantities really take fire sooner than large ones. The substances named were saturated with various fluids—oils, turpentine, petroleum, various varnishes, etc. All the fibrous materials took fire when saturated with any of these oils, or with mixtures of the same; sponge and wood dust, on the contrary, proved to be entirely harmless. Combustion ensued most rapidly with seventeen grains of wadding and sixty-seven grains of a strong oil varnish, namely in thirty seven minutes; while two hundred grains of washed cotton waste, of which a portion was saturated with seven hundred and fifty grains of strong oil varnish and the remainder wrapped about it, required a period of well-nigh fourteen hours. On these materials being placed in a well-sheltered spot and subjected to a heat of from 18° to 40° C., silk did not flame up, but slowly charred: and, as already mentioned, small quantities seemed to take fire sooner than large.

PRICE INDICATOR FOR GAS METERS.

A gas meter is by no means a very difficult instrument to understand, yet the majority of gas consumers are unable to tell how much gas has been consumed by an examination of the meter, and the consequence is that disputes frequently arise between the gas manufacturer and the consumer, which might be entirely avoided if some means were provided which would enable the gas consumer to tell at any moment just how much is due the manufacturer.

Mr. Frederic Egner, of Norfolk, Va., has recently patented a price indicator for gas meters which obviates difficulties of this nature, and always shows in dollars and cents the amount due for gas.

The invention is very simple, and may be applied to meters already in use, or it may be made a part of a new meter. It consists of an endless band having printed on it figures representing dollars and cents advancing regularly in some fixed ratio. This band is mounted on two rollers in an auxiliary case attached to the meter case, and is driven by a simple train of gearing from the "hundred" pinion of the registering mechanism.

The gas consumer may at any time know how much he is indebted to the gas manufacturer by noticing the figures visible through an opening in the case containing the endless band. The meter inspector carries a key to the case containing the band, and the latter may at any time be turned back to the zero point by loosening the lower roll, and should the scale of prices be changed a new band may be supplied at a trifling expense.

EGNER'S PRICE INDICATOR FOR GAS METERS.

This invention is well calculated to settle many of the disputes arising between the gas consumer and the gas manufacturer, and it affords an effectual check on meter inspection, insuring correct statement.

This useful improvement is the invention of Mr. Frederic Egner, of Norfolk, Va., who may be addressed for further information.

Lunar Caustic for Purifying Spirits.

Although some sorts of spirits are associated in our minds with lunatics, and others with "moon-shiners," the subject of which we are about to speak is of a quite different nature, being at once scientific and practical.

Berlien has discovered the fact that raw spirits can be purified by treatment with a solution of nitrate of silver and subsequent rectification. From two to two and a half parts of dry nitrate of silver are sufficient for one million parts of crude spirits, a ten per cent water solution being employed. The odor is entirely removed from the worst quality of crude spirits by this infinitesimal amount of silver; a good quality of raw spirits requires correspondingly less, and a one per cent or a one-hundredth per cent solution of silver is then employed.

IMPROVED STEAM BOILER.

The boiler shown in the annexed engraving is intended to accomplish three very important results: First, the rapid generation of steam by a complete exposure of the water to the action of the fire; second, to superheat the steam by forcing it into contact with the smoke flues through narrow openings; and third, to prevent the destruction of the upper ends of the flues by cooling them with the moisture carried up by the steam.

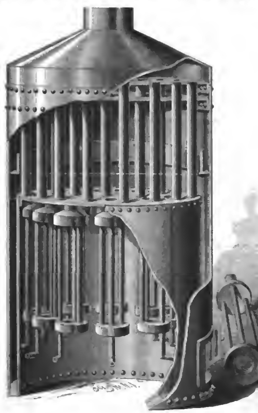
To accomplish the first result a series of flues are arranged in clusters in the fire box, as clearly shown in the engraving. These clusters, generally composed of nine tubes each, are each joined to a single tube passing through the crown sheet. By this arrangement a great extent of water surface may be exposed to the heat without obstructing the smoke flues or taking up a great deal of the crown sheet surface. A circulation is maintained through a tube connecting the lower end of the cluster with the water-leg of the boiler.

It will be noticed that near the upper head of the boiler there is a horizontal partition dividing the steam room of the boiler into two portions, the upper portion being the reservoir for dry steam. The apertures through the horizontal partition are a little larger than the flues, so that the steam in passing to the upper compartment of the boiler is brought into close contact with the flues and superheated. This not only relieves the steam of all superfluous moisture, but it tends to preserve the flues by preventing overheating.

This boiler presents a large and efficient heating surface, and it has, without much additional cost, a superheater which will always supply dry steam.

Between the horizontal partition and the tube sheet a ring of L-shaped cross section is attached to the inner surface of the boiler shell, forming a receptacle for mud and other impurities in the water, which are carried upward by the natural circulation of the water, and which, in boilers of ordinary construction, find their way to the water-leg, impeding the generation of steam and working destruction to the boiler

The inventor informs us that he can generate 100 lb. steam pressure in five minutes with this boiler, and that it will rapidly and economically generate steam for continuous work. The boiler is especially adapted to steam fire engines and other forms of portable engines where both compactness and great power are required. These boilers are made by the La France Fire Engine Company, of Elmira, N. Y., who should be addressed for further information.



LA FRANCE'S PATENT STEAM FIRE ENGINE BOILER.

Tree Culture on Waste Land.

Hitherto the abundance of natural timber in this country has made it easy to dispense with timber culture, and for the most part our land owners have taken little interest in such slow-growing crops. This state of things, however, is rapidly passing away. The demand for special woods for manufacturing purposes is steadily and rapidly increasing, while the natural supply is diminishing and must ultimately become quite inadequate. Meantime there are millions of acres of land suitable for timber culture and for nothing else, except poor pasturage that our land owners are allowing to lie waste and idle for lack of a little forethought, and too frequently our would-be thrifty farmers will risk their surplus means in wild cat speculations, promising but never yielding large and speedy returns, when the same money spent in planting timber would soon convert their worthless swamps and stony places into valuable properties.

A correspondent, writing from Wisconsin, tells of a piece of land that was planted with walnut twenty-three years ago. The land was flooded every spring and summer, and was unfit for any ordinary cultivation. The trees are now from sixteen to twenty inches through, and have been sold for $27,000. No particulars are given as to the cost of planting the grove or the amount of attention it has had during the years of growth. There can be little doubt, however, that the investment was small in comparison with the return, and the land would otherwise have remained entirely unproductive. To the country the timber crop was so much clear gain. It is clear that our national resources might be enormously increased by a similar utilization by timber culture of lands which are now left unused and unproductive; and the planters would find their groves a surer investment for the security of their family possessions than any savings bank deposit.

Photozincotypes.

Ie Moll's *Notizen*, Herr J. Husnik writes as follows on photozincotypes with a sensitive asphalt solution:

We have at last reached the point of a more intimate knowledge of asphalt, and have thereby obtained a correct explanation of many of its properties hitherto kept secret.* It appears that by treating this substance with ether certain less sensitive components are removed, so that a residue "insoluble in ether" is left, which possesses in a considerably higher degree that sensitiveness to light so much desired in order to render the asphalt process practically useful. The way in which asphalt manifests its sensitiveness to light consists in becoming insoluble, or difficult of solution in its usual solvents, after exposure. Thus, a zinc plate, coated with an asphalt solution, which has been exposed for some time under a linear negative, may be developed by spirit of turpentine, so that all the whites dissolve while the lighted parts remain undissolved. And if, after fully developing, the zinc plate be washed first with spirit and then with water, and now allowed to become perfectly dry, the operation of etching may at once be begun; but, as such a plate had formerly to be exposed for hours in the sun, and for days—in winter even for weeks—in the shade, in order to get a good picture which could be developed with turpentine, it was not possible to turn the process to practical account. Gillot, Yves, and Barret, and other firms in Paris have, however, employed the asphalt process for years, but the secret of the greater sensitiveness of their solution was never known.

In Switzerland and America also one often heard of the asphalt process being employed for zincography, and, as already mentioned, the veil has now been torn from the secret. We know at last that progress in this process is to be sought in the direction of elimination from the solution of the insensitive particles.

Such a sensitive solution can, when requisite, be diluted with a little anhydrous benzole (not benzine, in which asphalt is insoluble). Benzole which contains a little water cannot be used either, as in drying it would cause the asphalt solution to wrinkle up and would not furnish an equal surface.

The solution must be kept perfectly free from dust. Before being coated the zinc plate should be carefully dusted, and any excess of the coating solution should be poured off into another vessel, and not back into the stock bottle until it has stood to settle for a couple of days, after which the upper part may be poured back. When the film has become dry it may be slightly warmed and then exposed under a clear line negative—preferably in the sun, as then only half an hour of an exposure is required. The plate is now laid in a bath containing oil of turpentine, and when the image has become visible the denser portions may be gone over with a small soft pencil, so that they may be developed at the same time as the lights.

When the shadows appear sufficiently clear, remove the plate and coat it with alcohol or place it in a bath containing alcohol, and when the oil of turpentine has been partially washed out, place it under a jet of water falling from a certain height, so that the water may come in contact with the whites and remove any oil of turpentine that might still be adhering to them.

The development is an operation requiring great care and rapidity of work, which can only be learned by practice. The plate, being well developed, is next warmed, and when it has cooled again the next stage is the etching. Should the shadows, however, not be deep enough, they should be gone over with a pencil dipped in oil of turpentine, and when that has been allowed to act for a short time the whole plate should again be washed in the above mentioned turpentine bath, and the procedure with the alcohol bath and the water tap repeated. This plan gives sharp pictures, and may be used with advantage for much reduced reproductions of woodcuts.

* Dr. Kayser's examination of the properties of asphalt.

ENGINEERING INVENTIONS.

An improved scow, from which the load can be dumped conveniently and rapidly, has been patented by Mr. John R. Knuth, of New York city.

Messrs. William H. Burden and Frederick C. Burden, of Cleveland, Ohio, have invented an improved car axle journal oiler which is simple and effective. It consists of two conical wheels connected by a square shaft, and pressed against the journal by a spring contained in the journal box. An endless chain is suspended from the shaft and extends into the oil in the journal box.

Mr. John U. Mueller, of Detroit, Mich., has patented an improved jetty shutter. The invention consists of one or more rows of piles, driven some distance apart somewhat back from the line of breakers and on the line of the intended improvement, said piles being securely connected some distance above water level with longitudinal beams, and further stiffened and secured by braces and ties, while fastened to the inner longitudinal beams are the shutters, which are intended to form a settling basin for the mud, sand, clay, gravel, etc., driven by the waves toward the shore.

Messrs. William P. Woodruff and Charles H. Woodruff, of New York city, have patented an improved elastic packing for piston rods and other rods that slide through stuffing boxes. It is so constructed as to retain its elasticity when pressed down by the gland. It is formed of a central core of metallic turnings, surrounded by a layer of cloth and alternate layers of anti-friction metal and brass in the form of narrow strips wound spirally upon the cloth-covered core, and in the combination, with such packing rings, of an anti-friction metal seat, having a large ring groove in its upper side and two or more small concentric ring grooves in its lower side.

Mr. Eugene H. Angamar, of New Orleans, La., has patented a boiler adapted for application to horse cars now in use, so as to utilize such horse cars without material changes. The invention consists in a boiler made in two portions, separated by a mediate chamber, the water and steam spaces of the parts being connected by pipes.

Astronomical Items.

A writer in the Providence *Journal* says: If the planet Neptune was discovered or supposed to exist on account of certain perturbations in the movements of Uranus, and if the erratic movements of Mercury reveal the presence of planets within his orbit, why should not the near approach of Jupiter to the sun stir up a commotion in his fiery elements? The sun is still diversified with spots, and the planet is near enough to perihelion to make his influence felt. Astronomers have been wise prophets thus far as to the influence of the commencement of the sun-spot cycle. Tornadoes and cyclones of extreme severity have borne witness to abnormal conditions of the atmosphere, and a wave of intense heat, such as has not occurred for a quarter of a century at this season of the year, has confirmed the exactness of previous observations. We must still expect the usual storms, waves of heat, and auroral displays that follow the maximum of sun spots; we have yet to learn whether the coincident perihelia of the four great planets will increase and prolong the elemental warfare. This is one of the most interesting problems of the day, as well as one of the most practical and important. It will not meet with a hasty solution, for the period of observation extends to the year 1885.

The June moon fulls on the 23d. The morning sky of the 3d will show a lovely picture of the waning crescent of the old moon, near to the brilliant Jupiter and his less distinguished rival Saturn. On the 6th, one day before her change, she will be near Venus.

The new moon of the 7th will be near Mercury on the 8th, Mars on the 11th, and Uranus on the 14th; and the waning moon on the 30th will again pay her respects to Jupiter. On the 22d there will be a total eclipse of the moon, which will be invisible in this portion of the globe, but will be partly visible in the Western part of the United States, and entirely visible in the Pacific Ocean.

Correspondence.

What is the Temperature of the Sun?

To the Editor of the Scientific American:

The voltaic arc affords a very ready means of comparison. The intensity of light in a good arc is fully equal to that of the sun. Therefore, the temperature of the sun is not greater than that of the arc.

The temperature of the arc is not greater than 60,000° Fahr. Therefore, the temperature of the sun is not in excess of 60,000; and those who have estimated into the millions have gone very wide of the mark. Rossetti's estimate of 20,000°, and Spoerer's of 27,000°, are nearer the point.

The light, and consequently the heat, condition of the sun can be very closely imitated in the incandescent electric light, whose temperature can be closely calculated. The voltaic arc emits light by reason of the incandescence of minute particles of carbon passing between the electrodes. In the incandescent light, so-called, the carbon is a solid mass. The dissociated particles of carbon in the arc are much more highly heated than the particles of the solid incandescent pencil, but the latter is homogeneous, and therefore more like the sun. To bring a carbon pencil to that point of incandescence at which it acquires the intense limpid appearance of the sun, no longer seeming an opaque mass but seeming transparent, it is necessary that the pencil should be heated above 12,000°. It is a veritable miniature sun, so far as the heat condition is concerned. Under no circumstances can its temperature exceed 50,000°, and the pencil even temporarily remain a solid; and even at the lower temperature volatilization occurs. Therefore, the temperature of the sun is not less than 12,000°, nor more than 50,000° Fah.

There is another way of arriving at the result:

The diameter of the sun is said to be 800,000 miles. The earth is said to be 95,000,000 miles distant from the sun. The diameter of the earth's orbit is therefore 95,000,000 + 800,000 + 95,000,000 miles, or roughly, 190,000,000 miles. The heating surface of the sun is represented by a sphere 800,000 miles in diameter, and if we imagine the diameter of the earth's orbit to be that of a hollow sphere surrounding the sun (its inner surface situated 95,000,000 miles from the source of heat), we can approximate very nearly the difference in the degree of heat where we are and at its source. As the diameter of the sun is contained in the diameter of the earth's orbit 237·5 times—as the heat of the entire surface of the sun is distributed over a space (the space of the surface of an imaginary hollow sphere having a diameter equal to that of the earth's orbit) 237·5 times the surface of the sun—it follows that the heat of the sun at the sun's surface must be 237·5 times as great as it is at the earth's surface; and if we assume a mean of 100° at the earth, the temperature of the sun must be 23,750°, no more nor less, and this corresponds very nearly with what I have observed in electric temperatures. W. E. SAWYER.

New York, June 5, 1880.

[NOTE.—Recent comparative photometric experiments between the light of the sun and the light of the electric arc show that the latter has a yellow tinge, the sunlight a purplish hue. This would afford ground for the inference of a higher temperature for the sun than that yielded by the electric arc.—EDS. SCI. AM.]

On a New System of Photography.*

BY L. WARNERKE.

When experimenting with various phosphorescent substances it occurred to me to apply it to photography, and the following are the results obtained up to the present moment:

I prepare a phosphorescent plate, either rigid or flexible, by applying phosphorescent sulphide of calcium, either in the form of paint or powder, to the surface of glass or paper. The coating must be very smooth and uniform. Several substances can be used to cement the powder. Balmain's paint answers fairly well, but I suggest that albumen may be found more suitable, because it forms, when mixed with phosphorescent calcium, a coagulum which protects the phosphorescent material from the destructive action of the atmosphere (carbonic acid and moisture) more effectually than anything else.

A glass may be coated with collodion and a luminous surface formed on it. The film may be stripped off, and this will be found to be the best process by which to produce a smooth plate.

The plate so prepared, and previously kept in the dark, is inserted in the dark slide and exposed in the camera. After exposure it is removed to the dark room and put in contact with a sensitive collodion or gelatine dry plate. After suitable exposure by contact the sensitive plate can be developed and gives, as the result, a negative with perfect gradation, but reversed.

Theoretically, instantaneous exposure in the camera should be sufficient to give the requisite impression to the phosphorescent surface; and, if this surface could be produced sufficiently fine and smooth, it would be so practically. However, a few seconds' exposure with bright light is sufficient to render the luminous image easily discernible in the dark.

There is, besides this, the means of allowing a great range of exposure in the camera; since if the luminous image be not strong enough, prolonged exposure of the sensitive plate in contact with it will correct the shortcoming. By warming the plate bearing the luminous image the luminosity will instantly be increased, and there will be a corresponding effect on the sensitive plate.

The luminous impression, as shown in my previous paper on actinometers, is persistent, and this allows several negatives to be obtained from one luminous plate. By this means it is observed that contact printing is unsatisfactory for want of, or by too much, exposure; it can easily be remedied without the necessity of giving another exposure in the camera.

There is, however, a certain particularity which must be taken into consideration—the luminous image is not sharp. I repeated my experiments in regard to this fifteen times, and I came to the conclusion that the phosphoro chemical focus is far away from the corrected focus of our lenses.

When once impressed the plate will remain luminous for many hours; but the luminosity can be extinguished by exposing it again to the light filtered through certain colored transparent media. Respecting this I may remark that the most suitable extinguishing substance can only be found by actual experiment. I had several sorts of red and ruby glass, and only two of them acted as an extinguisher, but required an exposure of ten minutes to the sun's rays.

I found a green aniline color dissolved in collodion or gelatine more serviceable. The exposure of two minutes to diffused daylight was sufficient to complete the extinction. Strange enough, I have green glass of exactly the same green color, but it does not act as an extinguisher.

I may mention here that by exposing the phosphorescent plate behind a negative a negative luminous image is obtained, which can produce a positive on the collodion sensitive plate put in contact with it, and in this case it will be quite sharp.

If the phosphorescent plate be exposed to the light, and then put in contact with a negative covered with an extinguishing medium, and again exposed to the light, the opposite result to that previously described will be observed.

By using a phosphorescent plate it is possible to obtain a photograph of the red end of the spectrum. To do this the plate is exposed entirely to the light; and when the spectrum is projected on it the rays of low refrangibility will extinguish the excited luminosity of the plate, leaving the lines of the spectrum luminous. This is printed on the gelatine or collodion plate.

The negative passed round for inspection was made under the following conditions: The phosphorescent plate was exposed in the camera for one minute, using a rapid rectilinear lens. The light was of medium quality. A gelatine plate was put in contact with the luminous image for five minutes.

* A communication to the Photographic Society of Great Britain.

AMERICAN INDUSTRIES.

[*Continued from first page.*]

establishment, and conveys a good idea of the activity prevalent here. The experimental work is carried on in the laboratory, which is fitted with all of the modern appliances for making electrical tests, and with a full line of chemical and physical apparatus. The machine work is all done in a machine shop covering an area of 80 x 120 feet, well stocked with machinery from the shops of the best makers in this country.

The wire used in winding the armatures and magnets is all covered by a simple machine shown in one of the views in our engraving. The same view represents the machines on which the armatures are wound. The machines and lamps are all thoroughly tested before being shipped.

The carbon rods used in the Weston lamp are all made here, the company having determined by careful tests that their own carbons are better than the French. The operation of making the carbons is very simple; the retort carbon, being ground to an impalpable powder, is mixed with a moistening liquid and forced by hydraulic pressure through a die, which gives them their cylindrical form; they are then baked for a number of hours at a high temperature, and after cooling are inspected and pointed for use.

The manufacture of electric lighting apparatus is now one of our leading industries, and it is likely to expand as the advantages of this system of illumination become better known.

The new works of the Weston Electric Light Company are located at 23 to 29 Plane street, Newark, N. J., and their New York offices are located at 92 and 94 Liberty street.

MISCELLANEOUS INVENTIONS.

Messrs. Lewis H. Raymond, of New York city, and John Roberts, of Dunellen, N. J., have patented a life raft made with sides of equal height below and above the floor, and having independent cylindrical air chambers fastened thereto between the seats above and below the floor, and also having air chambers, made in compartments, formed between the sides at both ends of the raft. The gunwale on the top and bottom of the sides and thwarts is held and braced by means of braces connecting the gunwale and the thwarts.

Mr. Christian J. B. Hirsch, of Zumbrota, Minn., has patented an improved pipe stem. The object of this invention is to furnish a short pipe stem which shall have the effect of a long one, cooling the smoke and allowing the nicotine to condense from the smoke.

An improved hanging lamp, patented by Mr. Otto F. Eichberg, of New York city, consists in combining with a cup perforated at the top, and forming an extension of the tube, an adjustable extension having an interior depending flange and exterior absorbent.

Mr. John S. Birch, of Orange, N. J., has patented a novel key ring, so constructed that keys and other articles can be conveniently placed upon and removed from it, and which will not be liable to become opened accidentally. The invention consists in constructing the key ring of a strip of metal bent into V form, with rounded angle, having its end parts bent inward and outward to form shoulders, having one of its ends longer than the other and bent into U form, and having a lug upon one end and a recess in the other end.

Mr. Augustus J. Kuhn, of Lewistown, Pa., has patented an improved drying apparatus, intended more particularly for drying sand, which, by its peculiar nature, is difficult to dry and inconvenient to handle; but this improved machine may be used to advantage in drying any material that will run through the machine. The principal objects of the invention are, first, to permit the use of exhaust steam for producing the drying heat; second, to save handling of the material from the time it is placed in a wet condition in the machine to its delivery in a dry condition; and, third, to permit the regulation of the feed and delivery according to the heat and condition of the material and to prevent clogging of the feed.

Mr. Jesse M. Harr, of Baltimore, Md., has patented improvements in that class of skylights which are made strongly and studded with thick glass disks and placed in the sidewalk for the purpose of illuminating the dark recesses of a cellar or vault without allowing the entrance of rain and without breaking up the continuity of surface or weakening the pavement at such points.

Mr. John F. Henderson, of Franklin, Ky., has patented an improved coffeepot designed to more thoroughly extract the strength of the coffee and without boiling. A pendent cylindrical water receptacle is placed in the top of the pot, and is provided with a straining sack below, in which is contained the ground coffee.

In preserving fruit, vegetables, and meats by what is known as the "refrigerating" process, a current of air of reduced temperature is, in many instances, forced into and through the chamber or receptacle containing the substances to be preserved. In other cases the air is drawn from a well or through a tube passing through a collar, the current being established and maintained by the rarefaction of the air in the preserving chamber. Mr. Louis G. Volkmar, of New York city, has patented a portable apparatus for use in drying fruit, etc., by means of a cold air current, which is conducted through a tube that traverses an ice box, and is so arranged therein that ice may be packed around and in contact with it.

Mr. Charles E. Wallin, of Salt Lake City, Utah Ter., has patented a horse cover or blanket which affords greater protection than the ordinary blanket to the breast and other parts of the body, also be more comfortable to the animal by allowing greater freedom of movement, yet less liable to rip or tear or become displaced when the animal lies down or gets up. These results are attained by the provision of a detachable breast piece, elastic straps, a pad, and gussets or gores attached to the body of the cover.

Mr. James R. Harry, of Yonkers, N. Y., has patented a novel top, so constructed as to contain the cord when not in use.

An efficient and powerful implement for raising stumps, roots, rocks, and other objects, has been patented by Mr. William H. Wright, of Belmont, N. H. The invention consists of a vertical U-shaped frame in which moves a ratchet bar, the frame being provided with a lever for lifting the ratchet bar, a latch for retaining the bar at the point to which it is lifted by the lever, and springs for throwing the latch in and out of engagement with the ratchet bar.

Mr. Leroy Brown, of Waitsburg, Washington Territory, has patented an improved sulky plow which is so constructed that it may be readily adjusted and controlled by the driver. It is simple in construction, strong, and durable.

Mr. Thomas Bickerton, of Lawrence, Kan., has patented a hand corn planter with a drop slide which will accurately drop the corn. The end plates are shaped so as to prevent dirt from getting between them when thrust into the ground.

Mr. William Lay, of Seneca City, S. C., has patented a cheap, simple, and powerful water motor for running machinery or performing other work. It can be operated with a small quantity and with but slight fall of water.

New York Elevated Railway Cars and Engines.

The total number of engines now running is 167, divided as follows: Second avenue line, 29; Third avenue line, 68, Sixth avenue line, 46; Ninth avenue line, 24. The cars as follows: Second avenue, 66; Third avenue, 221; Sixth avenue, 152; Ninth avenue, 49. Total, 488. The combined mileage of the Eastern Division is about 269,400 miles; of the Western Division, about 146,000. Total mileage per month, 515,400 miles. These engines make two and a half stops to the mile, making an average of over one million train stops a month.

IMPROVED BRICK MACHINE.

In the manufacture of bricks, a class of machinery is required which will not only turn out bricks perfectly and rapidly, but will also be capable of resisting the wear and strain naturally coming on such machines, and be entirely free from liability to disastrous breaks.

Mr. W. E. Tallcot, of Croton Landing, N.Y., the inventor of the machine shown in the annexed engraving, having had many years of practical experience in the manufacture of bricks and brick making machinery, and having seen the defects of former machines, and knowing the requirements of a really good brick machine, invented, patented, and perfected a very successful machine, provided with safety devices at every point where breakage would be likely to occur. Mr. Tallcot being located on the Hudson River, in the great brick-making center of the United States, has had excellent opportunities for studying the requirements of this industry, and his efforts have resulted in the construction of the machine shown in our engraving. It is made wholly of iron, the base frame being a strongly arched and ribbed casting, having broad feet, which are secured to a suitable foundation. The tempering mill cylinder, A, is bolted to the base frame, and contains a tempering shaft, B, carrying a number of iron arms arranged spirally, and having at the lower end a sweep, shown in detail in Fig. 2. The tempering cylinder is made of large size, giving the machine perfect tempering capacity, which is very important in the manufacture of a fine quality of brick.

The upper end of the shaft, B, carries a large bevel wheel, and is journaled in a strong iron frame secured to the top of the tempering cylinder, A. This frame supports the horizontal driving shaft, also the shaft which operates the pressing mechanism, and it serves to keep all of the main driving parts accurately in line.

The press box, C, attached to the front of the tempering cylinder, contains a plunger which is driven through a forked connecting rod from the rock shaft, D, which receives its motion from a crank on the end of the shaft, E. This connecting rod straddles a standard which is secured to the packer or plunger. In the lower end of the connecting rod there is fixed a pin which passes through both branches of the fork and through a vertical slot in the standard. This pin acts against a cast iron press-pin which passes from the front across the vertical slot in the standard, thereby giving the proper downward motion to the plunger. The plunger is raised by the upward movement of the connecting rod. The press pin may be placed in different holes in the standard to vary the throw of the plunger, and when an extraordinary strain is exerted on the cast iron pin, by the entrance of a large stone or other hard body into the presser box, the cast iron pin breaks and relieves the other parts of the machinery.

The clay which is tempered in the cylinder, A, is forced by the sweeps into the presser box, and is pressed downward by the plunger through rectangular openings in the bottom of the presser box, C, into moulds resting on the table, I, below the presser box. At proper intervals, and timing with the other parts of the machine, the levers, F, move forward, carrying a rod which pushes an empty mould forward against the filled one, forcing the latter out on the table, I, and putting the empty one in its place. The movement of the levers, F, is effected by a cam on the end of the shaft, E, through an angled lever, H, and connecting rod, G. This connecting rod is jointed at its lower end to a hooked arm, K, which engages the end of a cast iron breaking rod held by an arm on the rock shaft carrying the levers, F.

The object in using the cast iron rod is to avoid the breakage of moulds and of the mould moving mechanism should a stone or other hard body partly enter the mould during the process of pressing. An additional safety appliance is seen in the front of the presser box, the lower portion of which consists of a gate or mouth piece pivoted at each end and extending the whole length of the clod cutter. This mouth piece is held in position by a vertical spring having a hooked end, which engages in the end of the arm, L. During the movement of the mould should a stone or other obstacle come in contact with this mouth piece, the arm, L, slips by the hooked spring, allowing the mouth piece to swing on its pivots, thereby permitting the obstruction to pass out without causing damage; but should the obstacle be too large to pass through the opening in front, then the breaking rod gives way, stopping the movement of the mould, and the obstacle may be removed.

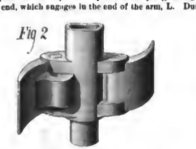
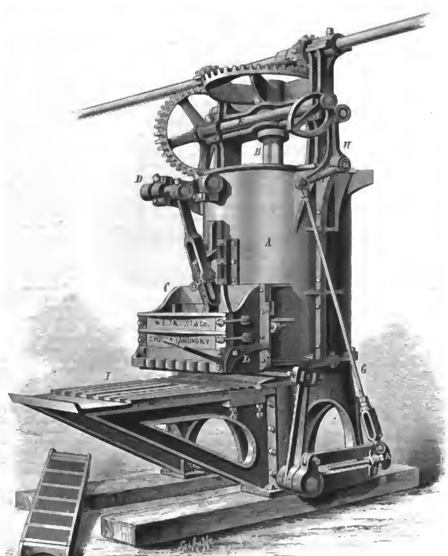


Fig 2



TALLCOT'S BRICK MACHINE.

The wiper or sweep shown in Fig. 2 is attached to a hub on the shaft by means of a pin passing through it, so that it may be easily removed and replaced should occasion require. It requires eight men and a boy to run one machine having a capacity of 84 bricks per minute. The bricks are turned out square, with well defined edges, and are of fine quality.

These machines may be seen in daily use at Croton Landing. Further information may be obtained by addressing Messrs. W. E. Tallcot & Co., Croton Landing, N.Y.

SNOW FOR PACKING FISH.—During the past winter Mr. F. P. Noble, of Carleton, New Brunswick, tried the experiment of storing snow for use in packing fish for transportation. He had three houses filled, and it is proving at once cheaper and less troublesome than ice for the purpose intended.

Experiments with Explosives.

Professor F. A. Abel, C.B., F.R.S., chemist to the British War Department, lately conducted a series of interesting and remarkable experiments on the proof grounds in the Government marshes adjoining the Royal Arsenal, Woolwich, in the presence of many spectators, including a number of officers and cadets of the Royal Navy. Professor Abel began by explaining that the violence of action of an explosive substance is regulated by the resistance opposed to the escape of the gases at the first ignition; and, furthermore, that the partial confinement of the disengaged gases by the mass of the explosive alone is sufficient to develop violent explosion. These examples he proceeded to illustrate by the first series of experiments, showing that gunpowder, and even so powerful an agent as mercurial fulminate, when ignited on the surface, produced a mild report in comparison with the result of similar charges ignited at the base of the heap. The next experiments were devoted to an exposition of the theory of detonation, the development of which, the professor said, was dependent upon the nature, quantity, and confinement of the detonator in relation to the nature and mechanical condition of the substance to be detonated. Thus twenty-five grains of mercurial fulminate exploded unconfined upon a mass of dynamite left the latter unimpaired, whereas only one grain of fulminate strongly confined produced detonation, and the dynamite was thereby exploded. Similar experiments were tried with corresponding results with gun cotton, loose and compressed, and other compounds, and then Professor Abel, having laid down the axiom that rigidity of the mass is essential to detonation, proved further that the facility and completeness with which detonation is transmitted from particle to particle of a mass of explosive material is regulated by the rigidity in the resistance to mechanical motion which the particles offer. The most perfect explosive agent known to modern science was nitro-glycerine, employed through the medium of some suitable absorbent, one of the best of which was collodion gun cotton, as used by photographers. A new compound of nitro-glycerine and an absorbent had recently been produced under the name of blasting gelatine, and this was pronounced to be the most violent explosive known to science. This gelatine, however, dispersed with little effect when fired in its ordinary state; but when solidified by freezing, which was easily accomplished, it destroyed the iron plate upon which it stood. The difference between explosion and detonation was next lucidly demonstrated. An open case containing five pounds of powder was placed upon an iron plate and exploded, but the plate was scarcely damaged; a similar quantity of gun cotton suspended four feet above the plate, however, completely crushed it, consequent upon the greater violence of the detonation and the suddenness of its development and transmission. The practical application of this rapid violence was displayed by the destruction of a bronze cannon by filling it with water and detonating therein a mere morsel of gun cotton. Various peculiar qualities of gun cotton were illustrated by successive experiments, and its power of transmitting detonation from one mass to another, as well as its rending capacity as distinguished from mere displacement, were evidenced in a startling manner by the destruction of a strongly-constructed stockade of heavy balks of timber, the tops of which were cut off level with the ground and thrown to a considerable distance. Other experiments followed, in which the efficiency and convenience of wet gun cotton were exemplified; and, in conclusion, a charge was detonated under water, throwing up a pyramid of spray to a great height.

Mr. Brown, assistant to Professor Abel, arranged the charges and fired them by electricity, and instantaneous photographs of the most remarkable displays were taken by the photographers from the Chemical Department of the Royal Arsenal.

NEW THERMO-ELECTRIC BATTERY.

BY M. A. NIAUDET.

This battery is frequently used and is much appreciated in Austria and Germany. It is made of different forms, of which the most recent, represented by Fig. 1, appears to us to be the best, since it requires only two Bunsen burners to set in action forty thermo-electric elements. There is another model of sixty elements, with three burners, which offers the same advantages as the one represented.

Each circular group of twenty elements should be separately considered. The following is the description of such a group:

The elements are arranged in a horizontal plane, and radially; the heated junctions being towards the center of the circle, and the cooled junctions at its circumference.

The two metals are: 1st. German silver (called *maillechort* in France and *neu Silber* in Germany), and, 2dly, an alloy of antimony and zinc, which fuses at a temperature slightly higher than the melting point of antimony.

These two metals are soldered (at least at the heated junction) without the intermediary of any other metal; the ends of the German silver wires pass into a little capsule of brass, which forms the bottom of the mould in which the other metal is cast. This capsule is shown at *c*, in Fig. 2, which represents two elements of the actual dimensions; it remains attached to the element and forms part of the apparatus.

Into the same capsule penetrates a small rod, *r*, of copper, the extremity of which is also enveloped by the cast metal; and by means of this rod the heat is conducted to the heated junction. The extremities of these copper rods are arranged in a small circle, and are held between two circular plates of mica, so that they all become heated by the same flame. In the apparatus shown, a Bunsen burner is adopted; but in some simpler apparatus the flame of a spirit (wood naphtha) lamp is used. The mica plate has the effect of concentrating and directing the heat of the flame on to the copper rods.

The object of using the copper rods at the heated junction will be seen from the following: The heated junction does not obtain its heat directly from the flame, but only through the intermediary of the copper rod; it is therefore protected against any accident through overheating, that is, against the fusion of the alloy, which would cause the immediate break down of the battery.

To avoid, at least partially, the loss of heat by radiation, these copper rods are inclosed, excepting at their extremities, within a small tube, shown at *t*, in Fig. 2. The cooled junction is altogether dissimilar; the fusible metal is here soldered to a plate of copper, to which is soldered the German silver wire of the next element. The plate of copper is of large surface, forming a cylinder through which the air circulates, with the production of a cooling effect.

These batteries have been subjected to careful experimental trial by M. Waltenhofen, of Prague; he has compared them with that of Marcus, and has found them to be much superior to it.

It was found in the previous experiments of M. Stefan, of Vienna, that the thermo-electric elements of Marcus may obtain an electromotive force of one-eighteenth volt, but this maximum is obtained only at a temperature close upon the fusing point of one of the alloys of which they are formed.

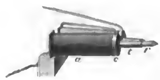
Under similar conditions, M. Waltenhofen found that the Noë elements possess an electromotive force between one ninth and one tenth volt.

In practice, these maxima, or anything near them, cannot be depended upon, and, when several elements are connected in series, they are never attained, because the elements are never equally heated. For ordinary experiments we may calculate upon one sixteenth volt per element. The resistance of each element is one fortieth Siemens' unit.

An improvement which is supplementary, but very useful in practice, consists of the addition of a regulator of the pressure of gas, by means of which any overheating, and the accidents which ensue from it, are avoided. It formerly sometimes happened that an unexpected increase in the gas pressure produced some fusion of the metal, and thus deteriorated the battery.

The safety apparatus here referred to, and which is shown in the front part of Fig. 1, consists of a glass bottle containing water, and closed by a cork. Two tubes enter this bottle through the cork; one, B B, is a branch from the gas supply, and passes to the bottom of the vessel; the other, H, does not reach the surface of the water. Its use is to lead away any gas passing into the bottle, and to conduct it to the small gas jet, I, which is kept constantly lighted. If the pressure of gas be low, the tube, B, is closed by the water; if it should become too great, the gas bubbles through the water and escapes at G, where it inflames. The apparatus thus constitutes a safety valve, preventing the pressure from rising above a certain degree, which can be regulated at will. The gas which escapes, being at once consumed, cannot give rise to accident.

FIG. 2.



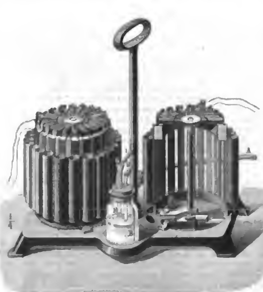


FIG. 1.—THERMO-ELECTRIC BATTERY OF M. NOE

With a battery of twelve elements, it is possible to work an electric bell; with twenty elements, water may be decomposed in the voltameter; with forty elements, a secondary battery of Planté may be charged, or an induction coil worked. In a word, these batteries allow of most of the experiments in physics, and small industrial operations, gilding, plating, nickeling, etc., being carried into effect.

One great advantage of this kind of electro-motor is that it is set in full action in one or two minutes, and all expenditure ceases the moment the current is no longer required. Lastly, and this is the most important point, the battery undergoes no alteration by use, as in the case of those which have preceded it, and which in a short time show a considerable internal resistance, and a corresponding diminution of effect.—*La Nature.*

THE CARP AND ITS CULTURE.

In the accompanying engraving we reproduce a careful drawing of the mirror carp (*Cyprinus carpio specularis*), so called on account of the large scales which run along the sides of the body. This is one of the three races of carp recently introduced into this country, the other two being the scale carp and the leather carp, the one entirely covered with scales, the other having few or none.

Three years ago the national carp ponds were established at Washington, in the old swamp and canal near the monument, and many thousand young fish have since been distributed for stocking suitable waters in Kansas, Nebraska, Missouri, Ohio, Indiana, Illinois, Pennsylvania, Maryland, Virginia, North Carolina, South Carolina, Georgia, Alabama, Louisiana, Texas, Tennessee, Kentucky, and New York. Persons desiring them for such purpose can be supplied on application to Prof. S. F. Baird, U. S. Fish Commissioner, Washington, D. C.

In a recent communication Professor Baird expresses great faith in the future of this new fish. He is quite well satisfied that within ten years it will constitute a very prominent portion of the animal food of the country. Although scarcely known in the United States, and but little more, as an article of extended application, in England and France, the carp is in Germany and Austria cultivated to the highest degree, so as to constitute a notable article of the market supply.

The fish itself is probably of Asiatic origin, and has been domesticated in China for thousands of years. It has, however, been so extensively distributed in Europe as to have become, in a measure, a native fish, occurring in public waters as well as in private enclosures. It is, Prof. Baird remarks, emphatically a farmer's fish; and may safely be claimed to be, among fishes, what chickens are among birds, and pigs and ruminants among mammals. Its special merits lie in its sluggishness and the ease with which it is kept in very limited enclosures, its being a vegetable feeder, and its general inoffensiveness. Trout and black bass require abundant water and a supply of animal food for their sustenance and growth; the carp thrive in shallow ponds, and while not disdaining flies, worms, larvæ, etc., live on the succulent roots and leaves of aquatic plants, seeds as they fall into the water, and other similar substances, and may be fed very readily upon corn, grain, bread, root crops, raw or boiled, and, indeed, any vegetable refuse.

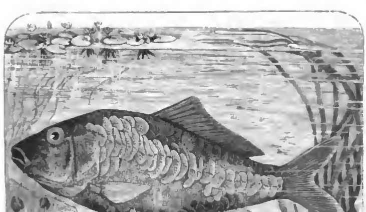
Their rate of growth, too, is something marvelous, and as observed so far in the specimens introduced into the United States, is even more remarkable here than in Europe. Among the original fish imported by the Fish Commission from Europe, and which are now only about three and a half years old, are some from twenty-five to thirty inches in length, weighing from four to eight or nine pounds.

The carp thrives best in artificial or natural ponds with muddy bottoms, and such as abound in vegetation. In large ponds it may not be necessary to furnish any special food, but in restricted enclosures, as, for instance, those of a fraction of an acre, they may be fed with the refuse of the kitchen garden, leaves of cabbage, lettuce, leeks, etc., hominy, or other substances. Grain of any kind is generally boiled before being fed to the fishes, but this is probably not absolutely necessary. The refuse of malt from breweries makes excellent food for them.

The Washington ponds are arranged so that they can be drawn off at will, leaving all the fish collected in a small basin near the outlet. This is for convenience in assorting the fish, and for selecting such as are needed for other purposes.

It is a prime necessity that there be no predaceous fish in the same pond with carp. Of course, the larger fish will be measurably secure against the attacks of carnivorous species of about the same size, but the eggs and young will become a prey to the rapacity of such associates. As a general rule the fish will thrive best when they are the sole occupants of particular waters, although the association of suckers and chubs would be less objectionable than that of sunfish, perch, or black bass.

The carp spawn in the spring, in May and June, and indeed, under some circumstances, throughout the entire summer. The Fish Commission have young fish that spawned from May to September. They are very prolific, yielding from 400,000 to 500,000 eggs, according to size. The eggs adhere tenaciously to whatever they touch, and for that reason it is very important that a new pond should be provided with floating weeds for such attachment. The eggs hatch out in a few days, and the young grow very rapidly. They feed voraciously upon the so called frog spittle, the green alga scum so common in



THE CARP AND ITS CULTURE.

frog ponds. Consequently such waters are especially adapted to carp.

Whenever the water becomes chilled down to perhaps 40°, and especially when frozen over at the top, the fish bury themselves in the mud, aggregating in lots of from fifty to one hundred, frequently with their tails projecting, and constituting what is called in Germany, kettles or roses. It is very important that they should not be disturbed under such circumstances. Of course, while hibernating in this way they are not feeding, although they are said not to lose appreciably in weight. In the more southern regions, where the waters do not freeze, they will probably feed throughout the year, and make a more rapid growth

So far, Prof. Baird says, no waters have proved too warm for carp; indeed, they are said to thrive especially well in reservoirs receiving the condensed waters of low-pressure steam engines, in Germany, of over 100° temperature.

As regards the best plants for a carp pond, Prof. Baird mentions the ordinary pond weeds (*Pontederia* and *Sagittaria*), splatter dock, or pond lily, and, indeed, any of the kinds that grow in the water, with leaves floating upon the surface, duckweed among the number. Those which produce seed, like the wild rice, are especially desirable, as the fish feed voraciously upon them.

The great merit of the carp for cultivation, next to its excellent table quality, lies in its adaptation to shallow and warm ponds unsuited for ordinary fish. The country is full of such waters, now useless, which might be made exceedingly productive; and there are thousands of swamps in every State, which might easily be flooded and stocked at small cost in money or trouble. In Germany many villages maintain at common cost for the public benefit carp ponds of a hundred acres or more.

RECENT DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Southern District of New York.

MANUFACTURE OF CELLULOID.—DANIEL SPILL *vs.* THE CELLULOID MANUFACTURING COMPANY.

(*Decided May* 25, 1880.)

Blatchford, J.: This suit, on the proofs, involves two patents granted to the plaintiff. One is No. 97,454, granted November 30, 1869, for an "improvement in dissolving xyloidine for use in the arts." The specification states that the "invention relates to the preparation and use of certain solvents of xyloidine, and which differ from the ordinary known solvents of xyloidine, in that these menstrua which are employed are not, necessarily, in themselves, solvents of xyloidine, but become so by the addition of the bodies, compounds, or substances herein referred to." It also states that the invention consists in the employment of eight different solvents. Only the second solvent is alleged to have been used by the defendant. It is thus described in the specification: "Camphor or camphor oil, or mixture of the same, in conjunction with alcohol or spirits of wine, the same to be employed in about equal proportions." The claim is in these words:

"The preparation and use of solvents of xyloidine, such as have been before described, so as to render xyloidine more easy of conversion into compounds containing xyloidine, which are suitable for application in the arts and for industrial purposes."

The defendant has infringed this claim by using camphor in conjunction with alcohol, as a solvent of xyloidine. The defendant mixes ground and dried xyloidine with pulverized dry camphor, and then immerses the mixture in alcohol until the xyloidine is dissolved. It is dissolved by the joint action of the camphor and the alcohol. Neither alone is a solvent of xyloidine. It is immaterial, so far as the invention and the claim of the patent are concerned, whether the camphor and the alcohol are mixed so as to dissolve the camphor in the alcohol and then the xyloidine is put into the solution, or whether either the alcohol or the camphor is first mixed with the xyloidine and then the third substance is added. The bringing of the three together, causing the xyloidine to be dissolved or softened, so as to be more easy of conversion or working into compounds or articles containing xyloidine, is the invention. Making use of the solvent power of camphor and alcohol, when in the presence of each other and of the xyloidine, is the essence of the invention. The use of the camphor and the alcohol in about equal proportions is not of the essence of the invention. They are stated by the patentee to be useful in these proportions. But the evidence shows that the real invention was the discovery of the fact that camphor and alcohol, when united, would be a solvent of xyloidine.

The novelty of the invention of this solvent is attacked, but without success. The evidence is voluminous, and has been carefully considered, with the result, that the defendant has failed to show want of novelty. The prior patents adduced and examined are the English patent to Cutting, No. 1,638, of 1854; and the English patents to Parkes, No. 2,359, of 1855; No. 2,675, of 1864; No. 1,313, of 1865; No. 1,095, of 1867; and No 1,611, of 1868. Parkes' pamphlet of 1867, and Gmelin's Handbook of Chemistry, of 1860, have also been considered, as well as the English patent to the plaintiff, No. 2,666, of 1867. No other anticipation than the above seems to be considered by the defendants' expert, and he does not allude to the pamphlet. Another defense relied on is, that one Parkes communicated to the plaintiff, in England, the knowledge that alcohol and camphor united were a solvent of xyloidine, and that the plaintiff never made the invention himself. On the whole evidence, the defendant has failed to establish this defense.

The other patent involved is No. 101,175, granted to the plaintiff March 22, 1870, for an "improvement in the manufacture of xyloidine and its compounds." There are five claims in the patent. The second alone is alleged to have been infringed. The specification says: "The second part of my invention relates to the bleaching of xyloidine, and is as follows: When it is desired to bleach or whiten the xyloidine, I bleach it directly after the removal of the acids, and before removing it from the vat. This I do by any of the well known means, preferring a solution of chlorine or a solution of chloride of lime or soda, which I add to the xyloidine, making use of alternate stirrings and rests, for a sufficient time, until the xyloidine is whitened. The solution is again drained off and the xyloidine is repeatedly washed with water, in order to remove any excess of bleaching agents or any residue from such agents, when it will be found to be ready to be submitted to pressure in order to free the same from water, and may then be opened out, so as to prepare it for drying, dissolving, or other purposes." The second claim is in these words: "The process of bleaching xyloidine in the manner herein specified." That portion of the specification which precedes the statement of the second part of the invention relates to the treatment of vegetable fiber or lignine with acids, to convert it into xyloidine and render it soluble in suitable solvents. The fiber is intimately mixed with the acids by appropriate means, then the acids are strained and pressed from the fiber, which is now xyloidine, and it is subjected to a washing and stirring with water until it is nearly or quite free from acids, and the water is then drained off. The washing is done in a washing vat. The bleaching, as before stated, is done "directly after the removal of the acids," and before the xyloidine is removed from the vat. The evidence shows that the real invention of the plaintiff in this regard was to bleach xyloidine by ordinary bleaching agents, directly after the converting acids had been washed out of it, and before anything had been mixed with it which might interfere with the action of the bleaching agents. This is, fairly, the sense of the specification. Whether the bleaching is done in the washing vat or not, or in a solution of the ordinary bleaching agent, or by such agent not in a solution, are immaterial matters. The essential discovery was, that an ordinary and well known bleaching agent, of the character of chlorine, or chloride of lime, or chloride of soda, if applied to xyloidine, when it had become such and had been freed from the converting acids, and while it remained in that state, would act upon it to bleach it. The defendant treats paper with acids to make xyloidine, then washes out the acids, then grinds it, and, while it is being ground, applies bleaching powders to it. The evidence is satisfactory, that one of such bleaching powders is permanganate of potash, and that it was a well known and ordinary bleaching agent at the time of the plaintiff's invention. Therefore, infringement is established.

It is contended for the defendant that the claim in regard to bleaching does not claim a patentable invention, because it is merely the use, to bleach xyloidine, of what had been before used to bleach fibrous material not converted into xyloidine. The true view is well expressed by Professor Seeley, the plaintiff's expert. The defendants' expert, Mr. Edward S. Renwick, had cited four English patents, those to Martin, No. 7, of 1861; to Reeves, No. 2,797, of 1860; to Collyer, No. 550, of 1859; and to Reeves, No. 3,293, of 1866, as describing the treatment of vegetable fiber with a solution of chloride of lime or of soda, substantially as the plaintiff's patent describes xyloidine as being treated with a solution of chloride of lime or of soda. Professor Seeley says:

"The patents referred to by Mr. Renwick cover inventions relating to bleaching, by means of ordinary bleaching agencies, the ordinary fibrous substances which are used for clothing, paper stock, etc. I do not find in them anything which has more bearing upon the novelty of Spill's invention than what might be included in the matter which Spill regards and defines as old and well known. Previous to Spill's time, the ordinary bleaching materials and methods were only applied to a peculiar class of substances, namely, those substances of fibrous character which were useful only by reason of that fibrous character. Spill's invention brings the utility of bleaching upon a new kind of material, and brings it where it was very desirable, but where it was supposed to be impracticable. It is true that pyroxyline (xyloidine) has a fibrous structure, but this fibrous structure is not any essential or useful property in it. In fact, in this art, pyroxyline does not become useful until the fibrous structure is destroyed. Pyroxyline is not useful for any of the purposes to which the materials formerly bleached were applied. Pyroxyline is very different, in chemical character and composition, from the old bleachable materials. If pyroxyline had not the fibrous structure, probably the question of invention in this case would not have arisen, for then it would have appeared plainly that the case would have been very similar to that of (suppose) bleaching charcoal by ordinary bleaching agents. In the absence of experiments, the bleaching of a substance like pyroxyline would seem impracticable, almost incredible. The theory of ordinary bleaching is, that the coloring matter of goods to be bleached is of a complicated and unstable character, and is destroyed by the powerful chemical action of the bleaching agents, chlorine, oxygen, etc. Inasmuch as pyroxyline, in its manufacture, has been exposed to the action of some of the most powerful chemical agents which are known, it is unreasonable to suppose that any of the unstable coloring matter could be left in it. The bleaching of pyroxyline has often been proposed and attempted; it was especially desirable in this art; but it is my opinion that a chemist would exhaust all other theories before he would think of ordinary bleaching agents for the purpose. The subject had come up in my mind several times before Spill's invention, and I was unwilling to credit the efficacy of his plans until they were actually demonstrated to me. I know of very few inventions where so novel and useful results have been obtained by such simple and unlooked-for methods." There is no evidence to countervail this view.

The defendant has introduced evidence for the purpose of establishing that the invention claimed by the plaintiff in regard to bleaching xyloidine was previously known to Parkes, and was communicated by him to the plaintiff, and was not in fact invented by the plaintiff. The burden of showing this is on the defendant, and, on the whole evidence, it has not succeeded in doing so.

The defendant claims to have shown that other inventions claimed in the two patents were not new, so as to affect the question of costs. But the attempt cannot be held to have been successful.

There must be the usual decree for the plaintiff, for an account and an injunction, as to the claims above held to have been infringed, with costs.

Horace M. Ruggles and Edwin M. Felt for the plaintiff.

William D Shipman, Henry Baldwin, Jr., and E. Luther Hamilton, for the defendant.

The Brooklyn Bridge.

On being re-elected President of the Board of Trustees of the Brooklyn Bridge, lately, Mr. Henry C. Murphy promised that the bridge would be ready to open for use by the Fourth of July, 1881. A large body of men are at work upon the approaches to the bridge on both sides of the river. It is thought that a couple of months will suffice to complete the stone and brickwork on this side, after the purchase of certain properties has been made. The Brooklyn approach is shorter and much nearer completion.

The machinery for putting up the superstructure of the bridge is ready in the towers; but the work has been delayed owing to the necessity of constructing special machinery to cut the steel for the chords of the bridge. The largest size of steel hitherto made at the Cambria Iron Works, the most extensive in the country, measured 7 inches by 7 inches. The bars for the bridge are 7 inches by 8¼ inches, and to cut them enormous shears had to be made and put in position. This caused a great delay in the preparation of the first 500 tons of steel. The second lot of 500 tons, it is expected, will be delivered in advance of the time specified in the contract.

New Mode for Photo-Gelatine Plates.

Prof. Geo. Herschell makes the following suggestions in a note to the *British Journal of Photography*:

I found that by adding one drachm of a dilute mineral acid (I used nitro hydrochloric dil. B. P.) to six ounces of rectified spirit, almost any quantity of gelatine would dissolve in it on the application of a gentle heat. Plates coated with this dried in about double the time collodion takes.

Having got so far, I took some of Kennett's pellicle, and dissolved as much as I could in one ounce of spirit with ten minims of the acid. I got a nice emulsion, which flows over the plate quite as easily as collodion does. The plates are quite hard and dry in ten minutes. The emulsion must be kept warm while coating.

I hope that some of the leading gelatine workers will take these facts up and put them on a good basis, as my time for experiments is very limited. I find that ether and chloroform act as well as rectified spirit as solvents of gelatine when an acid is added. I have not had time to expose my plates yet.

The Survey of the Gulf Stream.

The sundry civil appropriation bill, just passed by the House of Representatives, provides for a survey of the Gulf Stream from its origin to its final whirl around the Sargasso Sea. The plan embraces soundings, deep sea temperatures, and current observations. The high importance of the proposed survey is clear, and when done it will add another valuable chapter to the nation's record of scientific exploration. The practical value of the proposed work, in its bearing on commerce and meteorology, is beyond estimation.

THE WONDERFUL CLOCK.—The astronomical clock invented and constructed by Felix Meier, which was illustrated and described in these columns some time ago, has been brought to this city for exhibition. In workmanship it excels the celebrated Strasburg clock, and it is a masterpiece of mechanical skill. The clock will remain on exhibition at Tammany Hall for some time, and it will repay any one interested in mechanical novelties to devote an hour in watching the movements of the figures and orbits in this wondrous clock.

Last of the Stevens Battery.

The Chancellor of New Jersey has ordered a sale of the Stevens Battery to be made by Washington R. Williams, Esq., Master, whom he directs either to make sale of the battery and its appurtenances as an entirety, or sell its materials, consisting of engines, etc., separately, whichever will yield the most money. Thus the great battery which cost the projector so much money, and was intended to be the pride of our navy and a terror to other nations, is to be sold for old iron.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

NEW BOOKS AND PUBLICATIONS.

MINES AND MINING IN JAPAN. By C. Netto, M.E. Professor of Mining and Metallurgy, University of Tokio, Japan.

To Professor H. Kato, President of the Department of Law, Science, and Literature, in the University of Tokio, are we indebted for a copy of an English translation of a report on the mining industries of Japan. This Report contains a description of the modes employed in opening, ventilating, illuminating, draining, and equipping mines, and also the processes used in smelting, roasting, washing, and assaying of gold ores. It also contains the laws which govern the mining industries of Japan, and a statement of the approximate products of both the government and private mines of the country. Another interesting feature in this Report is a number of very well executed engravings representing the implements used by the miners, many of which, are not unlike those used by our own miners.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. M. M. G. writes: In your number of April 24 you ask for a mode of killing moles. Pills made of lard, flour, and a very little strychnine dropped into their holes will kill them. Corn or ground peas soaked in a strong decoction of strychnine will kill them. Perforate their holes with a small probe and drop in the poison. [Should any of our readers try the above, they should bear in mind that strychnine is one of the active poisons and should be used with great caution.]

(2) H. K. M. asks: 1. Please inform me of some good book on steam engines and the price. A. Forney's "Catechism of the Locomotive," Edwards' "Catechism of the Marine Steam Engine," Roper's "Horse Power of Land and Marine Engines." 2. Can you tell me of any preparation by which I can take grease off pigeons? They get in the garbage and get grease all over the breast, and the grease gets in the pores of the eggs, and they will not hatch. A. Try benzole. 3. What is the best polish for walnut wood? A. Thin alcoholic shellac applied with a drop of oil on the polishing cushion. 4. What is the difference between a moment of force and a moment of time? A. See definition of moment in Webster.

(3) G. D. asks if there is any process by which bone can be softened so as to be cut in any size or shaped piece wanted, and afterwards the piece so cut hardened back to its original hardness. A. Bone may be softened by boiling it in muriatic acid diluted with two parts of water, hardened by digesting in lime water.

(4) S. E. asks: What chemical can be put on black walnut to prevent the fire from burning it? A. Wood may be rendered to some extent non-inflammable by saturating the fibers as far as may be with a hot saturated aqueous solution of commercial tungstate of soda, and then drying slowly.

(5) W. W. asks: Can you tell me of anything that I can use in parlor match composition to prevent the crack? I have been using 4 oz. glue; 4 oz. whiting; 2 oz. crocus; 12 oz. potassum; 1 oz. phosphorus. A. Coat the heads by dipping with a common shellac varnish: shellac (common), 1 lb.; wood alcohol, 1 quart. Swift & Courtney's match is said to have the following composition:

Phosphorus	30
Glue	5
Water	30
Sand	20
Binoxide of lead	20
	105

(6) R. E. A. asks how to make a mucilage in stick form (solidified), also would like to know of best plan for making a thick ink suitable for "Stephens' Automatic Pen." A. Dissolve gum arabic in hot water to form a sirupy liquid, add a little clove oil and thicken with powdered gum dextrine; mould and dry slowly. Concentrate a good iron gall indigo ink by evaporation over a gentle heat. Or dissolve soluble nigrosine in hot water to form an ink of the requisite consistence.

(7) R. H. S. writes: Putting common salt on a hard coal fire that is almost out seems or does revive it. Will you please give me the chemical action that takes place. A. Salt does not materially aid combustion. If the fire is hot enough the salt is volatilized; if small, the salt is more likely to extinguish it, we think.

(8) F. H. C. asks (1) how to remove rust from brass screws and trimmings, or mountings on a camera that has been exposed for a long time to dampness. A. Probably the best way to clean your brass work is to repolish with emery paper of different grades, finishing with crocus cloth. 2. How to ebonize cherry or pine wood, with details of the logwood preparation. A. For directions for ebonizing wood, see p. 91 (16), Vol. 40, SCIENTIFIC AMERICAN.

(9) W. P. asks for the most practical method, if there is any, of destroying the canker worm after it has gained a foot hold in the tree. A. Try syringing the tree with soap suds to which has been added a little hellebore.

(10) R. G. asks for the best method of putting new counters in seal presses (notary, etc.) A. They are usually cast in type metal in the same way that stereotypes are cast, but an easier way is to take a piece of guttapercha, soften it in warm water, put it in the press, and bring the seal down on it. A counter of this kind does not last as long as metal, but it may be very readily renewed.

(11) E. L. K. writes: 1. I am making a boiler like the one described in SUPPLEMENT 182. The tubes are three inches in diameter and 18 inches long. Will it do to make the casing, which is 16 inches in diameter, of cast iron? A. If you refer to the boiler on page 2901, you can make the casing of cast iron, but it should be lined with fire brick or some other non-conductor. 2. How large an engine will the boiler run? A. It will depend upon the speed of the engine and the pressure you wish to carry. 3. How much pressure will it safely stand? A. If the tubes are properly proportioned and sound, 120 to 140 lb.

(12) H. writes: I desire to make a small ice box, one in which I can preserve for twenty-four hours a few pounds of ice. What is the best material to pack such a box with, and how thick should the packing be? A. A box with a 2½ inch air space between the walls all around answers very well, providing the air space be perfectly tight. Saw dust, when dry, makes a good filling. Powdered charcoal is frequently used.

(13) J. T. H. asks: Has any one ever used a line of shafting laid at an incline in place of horizontal? Will such a shaft inclined say one foot in ten, 2½ diameter, 100 feet long, work? A. A shaft inclined one foot in ten will work, but all connections with it must be made to conform to the angle.

(14) W. H. P. asks for a rule for calculating the pressure of steam on a cylinder boiler at any given number pounds of steam. A. Multiply the diameter in inches by the length in inches and by the pressure per square inch; the result is the total pressure tending to rupture the boiler.

(15) R. F. R. writes: I made a copying pad after the receipt given in the SCIENTIFIC AMERICAN, but I notice the copies have a faint color; I think they should be darker. Can you tell me what to put in with the ink to produce a clear impression? A. In preparing the ink use pure methylaniline violet (3 B shade) or blue, and see that the solution is complete before attempting to use it. If the directions are properly carried out there will be no difficulty. If the ink does not flow readily add a little more alcohol.

(16) G. W. R. asks: 1. How can I find the pressure of wind per square foot at different velocities? A. Use a wind pressure gauge or anemometer. 2. Why is the common galvanometer not used in receiving dispatches on the Atlantic cable instead of the looking glass attachment which requires a darkened room? A. Because the pencil of light from the reflector forms a very long index having no weight. 3. What would be the cost of one of Edison's lamps and generators ready for motive power? A. We believe they are not in the market yet. 4. How high will a pressure of fifty pounds per square inch raise water? A. 112 feet. 5. How much is air compressed at a pressure of fifty pounds per square inch? A. 4.39 times or volumes. 6. Is a rotary bellows the best machine for compressing air to the above pressure? A. No. 7. Is a rotary engine best for applying its power to machinery? A. No. 8. Is compressed air the best agent for keeping a power which is supplied (irregularly) for future use (once in 24 hours)? A. You may use compressed air, but a column or head of water is to be preferred.

(17) F. W. & Co. ask: What can be used to remove the gloss on tin cake cans so as to make the labels stick well which are put on with flour paste? A. Try strong hot solution of caustic potash or soda.

(18) J. T. asks what to put into glue to make it perfectly insoluble. A. Glue is rendered insoluble by tannic acid (tannin). The tannin may be dissolved in a small quantity of soft water.

(19) A. P. G. asks: What will remove soil spots, such as grease and dirt, from parchment paper, such as diplomas are written upon? A. To remove the grease spots cover with hot pipe clay and place under pressure for a few hours. Dirt stains must be removed by mechanical means.

(20) W. H. asks: Is there a single engine made to reverse with one eccentric, without changing the position of the eccentric on the shaft? A. Yes, by making the valve without lap or lead.

(21) J. J. W. asks how Leghorn hats are whitened (otherwise than with the fumes of sulphur), or can you give a receipt to whiten with a varnish? A. Immerse in a strong aqueous solution of sulphite of soda or bleaching powder (chloride of lime) and then in dilute sulphuric acid (acid 1, water 5). The bleaching powder treatment requires much subsequent washing, or the use of an antichlore dip, hyposulphite of soda dissolved in 20 parts of water.

(22) A. B. H. asks for some simple test for water to see whether it is safe to use or not. I took some tannic acid and put it in well water. No. 1 turned greenish blue; No. 2 acquired a reddish tinge; No. 3 bluish green with quite a deposit on the bottom of the tumbler and quite a bit of substance floating around in it. The surface of all these waters had a glassy look. The water was hard. No. 4 was water taken out of a cistern; the acid did not change this water. Please tell me what the above tests—if they can be called tests—indicate? A. Pure tannic acid (tannin) causes a bluish or greenish blue discoloration or precipitate in water containing salts of iron—with which it forms ink. When the water contains any considerable quantity of gelatine or albuminous matters, tannin occasions the formation of a finely divided precipitate, at once or after standing for a time. When the quantity is small this gives the water an opalescent appearance, and sometimes a slightly pinkish tint when viewed by transmitted light. After remaining in a warm, quiet place for some hours, the precipitate separates as a curdy or semi-gelatinous mass. Such water may be considered unfit to drink. Before using the tannin solution should be allowed to stand for some hours and should then be filtered.

(23) R. F. asks how to clean rubber stamps. A. Try a little strong hydrochloric acid.

(24) S. L. writes: I propose building a double boat, 80 feet long, ¼ inch iron, air tight; each boat 30 inches in diameter, joined by staunchions making an outside beam of 12 feet. 1. What would be the carrying capacity? A. We cannot give the carrying capacity without knowing the form of your cylinders. 2. Would it carry engine power sufficient to propel at rate of seventeen miles per hour, and the power required? A. No, not with paddle wheels. 3. What diameter of side wheels, with feathering floats, would be required, and the number of buckets to each wheel? A. You cannot put in wheels of any size that will give the speed. 4. What would be the best coating inside and out to keep the iron from rusting on a fresh water lake? A. Brown oxide paint ground in pure linseed oil. There is a catamaran steamboat building here, which will be completed within the next sixty days. We advise you to wait the result, before investing your money in a similar project, if speed is your object.

(25) O. & D. write: Owing to the mildness of last winter the ice crop was scarce and the price is high. Is there not some simple way by which one can at little expense reduce the temperature of our city water, so as to render it a little more drinkable? I thought of using a jar and covering it with a layer or two of some coarse cloth, and keeping a small stream of water running on it, just enough to keep it wet. Would the evaporation reduce the temperature materially and what part of the house would it be best to keep it? Perhaps there is some better method, if so, I am sure you would confer a great favor on many who cannot afford to take ice this summer. A. The simplest form of water cooler is perhaps the porous (unglazed) earthen jar. When filled with water the latter oozes slowly through the porous material, evaporates, and keeps the jar cool. The jar must, however, be kept away from heat radiating surfaces. The plan you suggest is also a good one; the cloth should not be too thick, and the jar should be as tall and narrow as convenient so as to expose as large an evaporating surface as possible.

(26) A. B. asks for a receipt to make ice cream. A. The following gives excellent results: Scald a gallon of good sweet milk, and add to it with constant stirring eight eggs well beaten with one pound white sugar, and four spoonfuls of cornstarch, first mixed into a thick cream with cold milk. Cool, flavor to suit and freeze.

(27) F. P. N. asks: Is there any sympathetic ink, or any preparation that may be used for writing, which will fade out completely within ten hours, or can the paper be so prepared as to cause the ink to fade out? A. An aqueous solution of chloride of cobalt forms an ink, writings made with which become practically invisible on ordinary paper at ordinary temperatures, and may be developed to a dark blue by gently warming. The addition of a small quantity of chloride of calcium or glycerine materially affects the rapidity of this change.

(28) G. S. H. asks: Can you inform me what will remove fungi from glass, which you described in the SCIENTIFIC AMERICAN dated May? We have a large glass, which has for some time been accumulating this fungi and which is continually spreading. A. Try fine rouge moistened with caustic soda solution in water.

(29) E. M. L. writes: 1. I am using ten feet of rubber hose to convey common illuminating gas from a chandelier to a small furnace for heating glue. It appears that the gas permeates through the tubing. Does gas permeate through rubber? If so, how can it be remedied? A. Diffusion takes place through such tubes, but the quantity escaping in an hour is very small and would escape detection by ordinary means. See that there is no leak in the tube or its connections. It would be difficult to obviate the diffusion. 2. I have a set of brass chessmen—how can I give them a black color? A. Dip bright in nitric acid, rinse quickly in running water, blacken by immersion in muriatic acid 12 parts; copperas, 1 part; white arsenic, 1 part; rinse, polish with sawdust or black lead, and lacquer well; or coat them with thin black japan, and harden the coat by heating in an oven.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. F. B.—No. 1. Syenite, sometimes metalliferous. No. 2. Chiefly copper sulphuret, probably carrying silver. Some of this may be quite rich in the latter metal—worth assaying. No. 3. Chalcedony—a variety of quartz of little value unless found in abundance and in large pieces.—D. N. P.—Ferruginous clay containing much carbonaceous matter. 2. Carbonate of lime and iron oxide. 3. Argillite. 4. Quartz. None of these is valuable.—B. T. W.—It is sulphate of lime gypsum.—A. M. R.—It is clay slate—of little value.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

May 25, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Air compressing apparatus, hydraulic, J. M. Bole ... 227,977
Animal trap, W. J. Webber ... 227,935
Apple corer, B. J. Hopkins ... 227,911
Ash pan sifter, H. D. Pursell ... 227,921
Asphaltum to a liquid, process and apparatus for reducing, D. W. Bailey ... 227,945
Auger, earth, A. J. Dinn ... 228,046
Awnings, gearing for adjustable, F. O. Pohl ... 227,989
Baling press, C. T. Christman ... 228,036
Baling press, P. K. Dederick (r) ... 9,212
Ballot box, H. Q. Norton ... 228,105
Bed, extension sofa, W. H. Lots (r) ... 9,214
Beehive, Kibler & Jenkins ... 227,939
Berth, self-leveling, W. Miller ... 228,100
Binders' and box board, P. M. Myers ... 228,102
Blacking machine, shoe, P. Andeye ... 228,028
Blind slat adjuster, J. F. Wise ... 227,967
Boats, construction of, Coughlin & Schneider ... 228,040
Bolts, device for swaging screw threads, T. Burke ... 228,033
Bookcase, F. Toerck ... 228,141
Bootjack, D. Will ... 227,983
Boots and shoes, machine for cleaning and polishing, P. Hills ... 228,073
Boots and shoes, making, L. E. De Ware ... 228,007
Bottle wrapper, I. Swope ... 228,032
Bracelet, J. M. Cockingham ... 228,039
Braid holder, W. P. Deane ... 227,964, 227,965
Breast strap slide, S. Ward ... 228,145
Bridle, J. W. Aiken ... 228,072
Brush machine, metallic, R. Bisbee ... 227,961
Buckle levers, machine for making, L. A. Sprague ... 228,136
Buckle, trace, D. Schoenthaler ... 228,174
Buckle, trace or tug, H. W. Wilson et al. ... 227,936
Building block, C. W. Frost ... 228,102
Burial casket, J. R. Nelson ... 228,104
Button, A. Milliken ... 228,006
Buttons, machine for making, Aston & Hames ... 228,011
Car coupling, W. F. Cutter ... 228,042
Car coupling, A. Kimber (r) ... 9,216
Car coupling, C. H. Shippee ... 228,127
Car coupling, G. Wood ... 227,942
Car door, freight, D. F. Van Liew (r) ... 9,219
Car heater, I. A. Salmon ... 227,997
Car heater, cooler, and ventilator, railway, N. N. Horton ... 227,977
Car motor, street, W. A. Gilday ... 228,053
Carpet sweeper, H. S. Wing ... 227,941
Casting chilled mould boards, H. B. Harris ... 228,064
Chain link, M. D. Greenwood ... 228,001
Check, banker's, J. Lewis ... 228,077
Cigarette mould, C. J. Brae ... 228,117
Clasp, J. B. Rhenbottom ... 228,119
Clevis, self-locking, M. H. Simmons ... 228,129
Cloth stretching super, McLoughlin & Almquist ... 228,050
Clothes pounder, J. W. Troeger ... 228,149
Clothes pounder, B. S. Wickle ... 228,050
Coal washing machine, S. Stutz ... 227,900
Cock eye, E. M. Kinne ... 227,904
Coffee roaster, E. N. Jenkins ... 228,106
Coffee scourer and cleaner, J. R. Merrihew ... 228,094
Collar, Goldsmith & Merrill ... 228,060
Compass, mariner's, A. Garnis ... 227,972
Copper from ores, extracting, Hunt & Douglas ... 227,903
Copying press, H. B. Hill ... 227,970
Cordage making machine, G. K. Winchester ... 227,940
Cork cutting machine, F. L. Blair ... 227,976
Corn sheller, B. A. Camp ... 228,029
Cotton chopper, W. Busch ... 227,979
Cotton picker, T. P. Monroe ... 228,101
Cotton picking machine, G. Beckman ... 227,949
Counting register, J. T. Hawkins ... 227,975
Crucible furnace, G. Fischer ... 228,049
Cut-off and governor, automatic, C. V. E. Downing ... 227,962
Damper, stove, C. A. Hamlin ... 227,988
Dental engine, H. M. Wilkerson ... 228,149
Derrick, portable folding, E. G. Bennett ... 227,975
Ditching machine, A. D. Martin ... 228,092
Dividing engine, S. Darling ... 227,982
Earrings, etc., fastening for, J. H. Purdy ... 227,989
Edger, J. A. Robb ... 227,936
Elbow pipes, roll for, Holder & Pfender ... 227,997
Electric light circuits, artificial resistance for, W. Sawyer ... 228,122
Electro-magnetic motor, C. A. Randall ... 228,116
Elevator, C. H. Golding ... 227,908
Elevator, C. R. Otis ... 228,107
Envelope fastener, A. Dahlem ... 227,961
Extension table, A. B. Hayden ... 228,066
Eyeglasses nose guard for, G. W. Wells ... 228,160
Eyelet punch and setting machine, combined, J. P. Wood ... 228,156
Faucet, W. C. Coddington ... 228,038
Faucet lock for beer coolers, A. Huittie ... 228,069
Feed water heater, E. Reynolds ... 227,925
Fence, barbed, W. G. Collins (r) ... 9,211
Fence post, A. Climie ... 228,037
Fence post, T. G. Orwig ... 227,990
Fence wire, machine for manufacturing barbed, Beers & Eaton ... 227,948
Fence wire, machine for manufacturing barbed, T. W. Eaton ... 227,969
Fertilizer distributers, force feed device for, Sheldon & Peacock ... 227,986
File, paper, W. L. Woods ... 228,137
Filter, E. Buss ... 227,984
Firearm, breech-loading, J. W. Livingston ... 228,037
Firearm lock, W. H. Baker ... 228,030
Firearm, revolving, D. B. Wesson ... 228,099
Fire box crown bar, E. Longstreth ... 228,080
Fire kindling apparatus, D. B. Smith ... 228,131
Fire, protecting iron columns from, J. McGiennesy ... 227,985
Floating dumping platform, M. Goodwin ... 228,058
Flour mills, collecting and grading dust of flour and grain in, S. L. Bean ... 228,025
Flour mills, dust arrester for, J. W. Collins ... 227,907
Folding chair, E. Tucker ... 228,144
Funnel and measure, combined, Smith & King ... 228,130
Furnace, G. D. Field ... 227,904
Furnace, C. B. Gregory ... 228,061
Furnace, C. Levey ... 227,906
Furnace, A. T. Morley ... 227,980
Game apparatus, C. A. L. Totten ... 227,931
Garden and lawn rake, combination, L. B. Belknap ... 227,951
Gas regulator, P. Kuller ... 228,079
Gates, apparatus for opening hinged, H. Allen ... 228,013
Gleaner and binder, C. L. Travis ... 228,033
Gold, apparatus for dredging and separating, H. B. Meech ... 227,980
Gold, etc., apparatus for dredging and separating, H. B. Meech ... 227,980
Gold from its ores, obtaining, A. C. Tichenor ... 228,140
Gold from its solutions, depositing, W. M. Davis ... 227,963
Grain cleaner, brush, L. Gathmann ... 227,980
Grain distributing machine, H. Fischer ... 228,050
Grain meter, J. W. Hill (r) ... 9,213
Grain meter, R. C. Meyer ... 228,095
Grain scouring and cleaning apparatus, L. Gathmann ... 227,991
Grain shovelor, S. R. Kirby ... 228,001
Grater and slicer, vegetable, J. F. Weitzel ... 228,147
Grinding mill, roller, J. Stevens ... 228,021
Hame fastener, A. Bander ... 228,022
Hame ring, A. J. Larson ... 227,942
Hammer, drop, M. Hawe ... 228,067
Harness clasp, G. D. Smith ... 227,989
Harrow cultivator, and seeding machine, wheel, F. Batchelor ... 228,021
Harrow, spring tooth, H. Gale ... 228,056
Harvester, J. M. Wishart ... 228,154
Harvester header elevator, T. J. Chappell ... 228,034
Heating furnace, J. J. Richardson ... 228,119
Holdback, vehicle, J. D. Watkins ... 228,036
Hoof parer, J. York ... 228,160
Hoop iron, apparatus for bundling, W. P. Bowding ... 227,988
Horse power machine, W. H. Hooker ... 227,980
Horses from running, device for preventing, H. A. Lehman ... 228,086
Hose, vulcanized rubber, J. H. Cheever (r) ... 9,220
Hub band, vehicle, G. W. Miller ... 228,097
Ice creeper, R. F. Prusner ... 228,114
Insulating compound for telegraph wires, Van Winkle & Donnelly ... 228,005
Insulator, telegraphic and telephonic, W. F. Jubbins ... 228,077
Knob attachment, M. Penfield ... 227,992
Labels, making colored, S. Crump ... 227,960
Lambrequin, C. J. Shipley ... 228,128
Lamp, electric, W. Sawyer ... 228,122
Lamp extinguisher, automatic, J. H. Ferriss ... 227,971
Lamp shade, J. S. Reitel ... 228,024
Lathing, wire, W. Bremann ... 228,030
Leather, uniting pieces of, E. J. Beane ... 227,942
Letter box indicator, electrical, G. P. Hurndon ... 228,171
Lighting device, E. L. Magill ... 227,987
Liniment, M. Berger ... 228,026
Locomotive signaling attachment, F. J. Wenker ... 227,938
Loom, J. M. Flagg ... 228,050
Loom harness, D. C. Brown (r) ... 9,220
Lubricating device, B. Stauffer ... 228,137
Mast or standard for vessels, etc., J. R. Shackleton ... 228,126
Measuring receptacle, I. D. Peck ... 227,919
Meat preserving compound, F. Artimini ... 228,016
Mechanical motor, N. J. Miller ... 228,099
Mechanical movement, W. S. Marshall ... 227,931
Metal bracket, A. B. Denison ... 227,946
Metallic can, hermetically sealed, J. Broughton ... 228,021
Middlings purifier, J. W. Collins ... 227,992
Middlings purifier, Hendrickson & Berstler ... 228,074
Millstone driver, W. H. Dickey ... 228,043
Mining and quarrying machine, coal, W. Weaver ... 228,145
Mower, J. J. Knapp ... 228,093
Mowers and reapers, cutting apparatus for, G. Beebe ... 227,950
Mowing machine, D. Wulf (r) ... 9,216
Nut, leather horse, J. C. Ayres ... 228,014
Oil can spout, D. N. Smith et al. ... 228,132
Oil can top, I. B. Bennett ... 228,022
Oils, coating the interior of vessels for holding, D. F. Bowker ... 228,024
Ore washing and concentrating machine, F. J. Seymour ... 228,125
Ores, leaching, D. W. Brunton ... 228,032
Organ bellows, L. K. Fuller ... 228,053
Organ, reed, M. J. Matthews (r) ... 9,218
Ornamentation of electro-plated and other goods, colored, W. H. & G. Wilkinson ... 228,150
Overalls, S. R. Krouse ... 227,981
Pantographs, pencil attachment for, J. T. Gregory ... 228,062
Paper box, H. S. Monson ... 227,916
Paper cutting machine, E. R. Sheridan ... 227,986
Paper lock box, G. C. Wenzel ... 228,020
Parer and corer, apple, R. McNew ... 227,913
Pavements, laying concrete, C. House ... 227,998
Pea sheller, L. Eaton ... 227,946
Pegging machines, suspending power, Woodward & Brock ... 227,944
Pen, fountain, W. B. Greene ... 227,904
Photographic plate holder, B. F. Spilman ... 228,134
Pipe coupling, W. H. Soper ... 228,132
Pipe mouthpiece, C. M. Mitchell ... 228,000
Pitcher, ice, H. E. Osborn ... 228,106
Planter, E. S. Plimpton ... 228,112
Planter attachment, cotton, C. W. Willcoxson ... 228,153
Planter, corn, W. H. Haworth ... 228,068
Planters, wheel scraper for, J. Kelly ... 228,080
Plowshare, B. E. Swartz ... 228,139
Plowshare fastener, J. P. Palery ... 227,931
Potato digger, J. H. Lewis ... 227,984
Precious metals from liquids in which they are suspended, recovering, J. Tunbridge ... 228,00-
Pulp, machine for making wood, N. Cowan ... 228,041
Pulverizing apparatus, Fairbanks & Breisig ... 227,920
Pump, H. S. Lockman ... 228,089
Pump, force, P. A. Myers ... 228,103
Railway, elevated, R. H. Gilbert ... 228,055
Railway rail ends into billets, etc., working, S. W. Baldwin ... 227,946
Railway rail joint, S. Harris ... 227,994
Railway rail joint, W. Neff ... 227,977
Railway switch, elevated, W. W. Riley ... 227,996
Railway train signal, A. H. Cottle ... 228,004
Rectifying spirits, apparatus for, F. F. Prentiss ... 228,113
Refrigerator car, Babbott & Smith ... 227,974
Rein, bridle and check, R. B. Williams ... 228,152
Rein holder, L. Grape ... 228,060
Rock drill carriage, N. W. Horton ... 227,980
Rock drill, steam, G. M. Githens ... 228,056
Rock drilling machine, S. G. Bryer ... 227,951
Rock drilling machine, R. Magill ... 227,908
Rope yarns from cotton, making, T. H. Dunham ... 227,965
Ruling machines, pen clamp bar for, W. O. Hickok ... 228,072
Salve, F. L. Crandall ... 227,958
Saw mill head block, Everitt & Avery (r) ... 9,217
Scales, platform, F. Fairbanks ... 227,969
Screens or bolts, device for clearing the meshes of, J. W. Collins ... 227,958
Sewer and catch basin, J. F. Lavery ... 228,084
Sewer grating, A. D. Lowell ... 228,091
Shade and curtain roller, J. R. Funney ... 227,989
Shaft coupling, H. Kline ... 227,960
Sheet metal cans, press and former for making the heads of, R. R. Robbins ... 228,120
Shoe, W. H. Wood ... 227,936
Shovel handle, W. Chisholm ... 227,991
Shutter, fireproof, E. H. Walton ... 227,934
Soldering iron, Smith & Joslin ... 228,000
Spinning machine, J. H. Allen ... 227,973
Square, bevel, D. Bissell ... 228,027
Stamp, hand, J. Leighton ... 227,906
Stamp, hand, W. W. Sawyer ... 228,121
Steam boiler, F. Trump ... 228,145
Steamer, culinary, H. T. King ... 227,905
Steamer, feed, M. Garmire ... 227,973
Stone saws, division block and holder for, S. D. Dougherty ... 228,048
Stove, H. Turner ... 227,933
Stove fume pipe, cooking, C. Illing ... 228,075
Stove grate, Ransom & Graves ... 227,924
Stump puller, J. S. Lloyd ... 228,088
Stump puller, B. S. Miles ... 227,914
Swing, A. B. Harmon ... 228,065
Swing and cradle, combined baby, Anderson & Talbot ... 228,014
Telegraph key, W. P. Phillips ... 227,113
Telephones, electric call for, C. B. Eaton ... 228,047
Thill coupling, W. A. Lovenway ... 228,090
Tire tightener, G. W. & E. Riebel ... 227,995
Tire tightener, W. T. Sprouse ... 228,135
Tobacco cutting machine, Crumley & Hagan ... 227,960
Tobacco, J. Rupp ... 227,927
Tool, combination, J. H. Randell ... 228,115
Toy insect, P. Von Ericheen ... 227,930
Toy railway train, F. W. Carpenter ... 227,956
Toy shuttlecock, W. Duchemin ... 227,964
Traveling bag lock, W. Lang ... 227,905
Unhairing machine, W. Gerber ... 227,974
Valve, A. C. Wood ... 227,983
Valve, change, J. Fowler ... 228,084
Valve motion and cut-off, R. O'Neill ... 227,918
Varnish, asphalt, J. Bruce ... 228,029
Vehicle seat, G. W. Merrill ... 227,913
Vehicle seats, rail fastener for, J. Law ... 228,083
Vehicle spring, J. M. Miller ... 227,915
Vehicle top, G. J. Peltier ... 228,110
Vent in vessels holding liquids, J. A. Wright ... 228,159
Wagon seat fastener, G. F. Wilson ... 228,151
Washing machine, F. K. Arnold ... 228,015
Washing machine, L. J. & W. M. Parsons ... 228,109
Washing machine, N. Thomas ... 228,139
Watch glass, J. H. Purdy ... 227,988
Water raising apparatus, I. C. Richardson ... 227,993
Water wheel, turbine, M. L. Bylington ... 227,980
Wells, polish rod adjuster for oil and other, W. H. Bieler ... 227,952
Wind wheel, A. D. Worman ... 228,158
Windmills, mechanical movement for, W. S. Marshall ... 227,909, 227,910
Window button securer, K. D. Hughes ... 227,974
Wood cutting machine, W. P. Campbell ... 227,956
Wood working machines, sectional shaft for, W. H. Doane ... 228,046
Wooden box, F. L. Wilson ... 228,031
Wool washing machine, F. G. Sargent ... 227,928
Wrench, E. Glyno ... 227,982

DESIGNS.

Book clasps, F. W. Burn ... 11,788
Carpeting, J. Forrester ... 11,787
Chain link, ornamental, E. F. Beery ... 11,790
Coffin handle sockets, W. E. Stevens ... 11,791
Monuments, J. & J. Pool ... 11,792, 11,793
Screws, coffin, B. A. Cuppers ... 11,795
Types, font of printing, W. W. Jackson ... 11,789

TRADE MARKS.

Alum, finely powdered, Harrison Brothers & Co. ... 7,999
Crutches, J. Whittemore ... 7,995
Gloves, Person, Harriman & Co. ... 7,991
Glucose, Fleckhardt & Kuttroff ... 7,992
Hair preparation, Hearn & Co. ... 7,990
Skin, preparation for chapped, Chase & Budlong ... 7,993

INDEX.

ILLUSTRATIONS.

MISCELLANY.

Figures preceded by a star (*) refer to illustrated articles.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

ROOTS' NEW IRON BLOWER.

POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED
IS SIMPLER, AND HAS
FEWER PARTS THAN ANY OTHER BLOWER.
P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., 6 Cortlandt St., 8 Dey Street, } NEW YORK.
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street,
☞ SEND FOR PRICED CATALOGUE.

Working Models

And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.

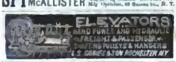
"BUCKEYE" LAWN MOWER.

The lightest and easiest running Mower ever made. Strictly First Class. MAST, FOOS & CO., Springfield, Ohio. Send for catalogue.

HEKTOGRAPH.

Patents have just been issued to us completely covering the process of dry copying, as follows: May 11, 1880, No. 227,338, and June 1, 1880, No. 228,362.
Therefore, all parties using a gelatine copying pad without our license are infringing our rights, and will be prosecuted to the full extent of the law.
The Hektograph is now the only apparatus for dry copying that can be legally used.
THE HEKTOGRAPH CO., 22 & 24 Church St., N. Y.

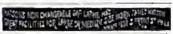
SPY Glasses, Field & Opera Glasses, MICROSCOPES, McALLISTER Magnifying Glasses. Circulars free. Mfg. Optician, 49 Nassau St., N. Y.



Delamater Steam Pumps,
For every variety of work.
WATERWORKS PUMPING ENGINES.
DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
Office, No. 10 CORTLANDT ST.,
Works, Foot of W. 13th St., North River, New York.
ESTABLISHED 1841.

BI-SULPHIDE OF CARBON.
E. R. TAYLOR, Cleveland, O.

GENUINE BABBITT METAL,
Fine Brass and Composition Castings.
E. STEBBINS M'F'G CO., SPRINGFIELD, MASS.



FRIEDMANN'S PATENT
EJECTORS
Are the cheapest and most effective machines in the market for
Elevating Water and Conveying Liquids
from Mines, Quarries, Ponds, Rivers, Wells, Wheel Pits; for use in R. R. Water Stations, Factories, etc. They are splendidly adapted for conveying liquids in Breweries, Distilleries, Sugar Refineries, Paper Mills, Tanneries, Chemical Works, etc. Send for illus. catalogue to
NATHAN & DREYFUS, Sole Manufacturers, NEW YORK.

Mill Stones and Corn Mills.
We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing specially adapted to Flour Mills. Send for catalogue.
J. T. NOYE & SONS, Buffalo, N. Y.

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought STRUCTURAL IRON.
It is believed that were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving insurance and avoiding all risk of interruption to business in consequence of fire. Book of detailed information furnished to Architects, Engineers, and Builders on application.

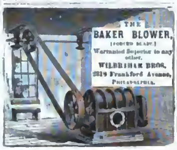
THE MACKINNON PEN OR FLUID PENCIL.

Particulars mailed Free.
MACKINNON PEN CO., 200 Broadway, near Fulton St., N.Y.

The New York Ice Machine Company,
21 Courtlandt Street. Room 54.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more ice. Uses only ¼ water of condensation. No Pressure at rest. Pressure in running, 14 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

WM. A. HARRIS, PROVIDENCE, R. I. (PARK STREET), Six minutes walk West from station. Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.

DROP HAMMERS, STILES & PARKER PRESS CO., Middletown, Conn.



WOOD SOLE SHOES. The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send stamp for circular and price list. CHAS. W. COPELAND, 122 Summer St., Boston, Mass.

BUY NO BOOTS OR SHOES Unless the soles are protected from wear by Goodrich's Hemacite Shoe Metals, guaranteed to outwear any other sole. All dealers sell them on boots. Tens by mail for 50 cents in stamps. Send paper pattern of size wanted. H. C. GOODRICH, 29 Church St., Worcester, Mass.

HARTFORD STEAM BOILER
Inspection & Insurance COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

The Rodier Patent Single Iron Plane.

Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

Chambers's Encyclopædia.

15 Vols. Over 13,000 Pages. Price During June, $6.

Among the wonderful things that have been accomplished for lovers of good books by the "Literary Revolution," perhaps the most wonderful is the reproduction of this great Encyclopædia at a merely nominal cost.

It is a verbatim reprint of the last English edition, in 15 beautiful volumes, clear nonpareil type, handsomely bound in cloth, for $7.50; the same, printed on finer, heavier paper, wide margins and bound in half Russia, gilt top, price $15.00. The first nine volumes are ready for delivery. Vol. 10 will be ready June 20. The remaining volumes will be completed by October next.

$6. An Amazing Offer. $6.

The more widely and rapidly these volumes are scattered, the greater is their influence in inducing other purchasers of this and our many standard publications. Accordingly we give special terms to early subscribers.

To all whose orders and money are received during the month of June, we will supply the 15 volumes, in cloth, for $6.00, and in half Russia, gilt top, for $12.00. To any one sending from any place where we have no special agent (usually the leading bookseller of the town) a club of five orders, we will allow a commission of 10 per cent. The volumes issued will be sent at once by express, and the remaining volumes when completed.
A specimen volume in cloth will be sent, postpaid, for 50 cents, or in half Russia, gilt top, for $1.00, and may be returned at once, if not satisfactory.
The "Chambers's Encyclopædia" comprises the first 15 volumes of our "Library of Universal Knowledge," and the remaining volumes, complete in themselves, will be sold separately when published.

Standard Books.

Library of Universal Knowledge, 21 vols., $10.50.
Milman's Gibbon's Rome, 5 vols., $2.50.
Macaulay's History of England, 3 vols., $1.50.
Macaulay's Life and Letters, 50 cents.
Macaulay's Essays and Poems, 3 vols., $1.80.
Chambers's Cyclopædia of Eng. Literature, 4 vols., $2.
Knight's History of England, 4 vols., $3.
Plutarch's Lives of Illustrious Men, 3 vols., $1.50.
Geikie's Life and Words of Christ, 50 cents.
Young's Bible Concordance, 311,000 references (preparing).
Acme Library of Biography, 50 cents.
Book of Fables, Æsop, etc., illus., 50 cents.
Milton's Complete Poetical Works, 50 cents.
Shakespeare's Complete Works, 75 cents.
Works of Dante, translated by Cary, 40 cents.
Works of Virgil, translated by Dryden, 40 cents.
The Koran of Mohammed, by Sale, 35 cents.
Adventures of Don Quixote, illus., 50 cents.
Arabian Nights, illus., 50 cents.
Bunyan's Pilgrim's Progress, illus., 50 cents.
Robinson Crusoe, illus., 50 cents.
Munchausen and Gulliver's Travels, illus., 50 cents.
Stories and Ballads, by E. T. Alden, illus., 50 cents.
Acme Library of Modern Classics, 50 cents.
American Patriotism, 50 cents.
Taine's History of English Literature, 75 cents.
Cecil's Book of Natural History, $1.
Pictorial Handy Lexicon, 25 cents.
Sayings, by author of Sparrowgrass Papers, 50 cents.
Mrs. Hemans' Poetical Works, 60 cents.
Kitto's Cyclopædia of Bib. Literature, 2 vols., $2.
Rollin's Ancient History, $2.25.
Smith's Dictionary of the Bible, illus., 90 cents.
Works of Flavius Josephus, $2.
Comic History of the U. S., Hopkins, illus., 50 cents.
Health by Exercise, Dr. Geo. H. Taylor, 40 cents.
Health for Women, Dr. Geo. H. Taylor, 35 cents.
Library Magazine, 10 cents a No., $1 a year.
Library Magazine, bound volumes, 60 cents.
Leaves from the Diary of an Old Lawyer, $1.
Each of the above bound in cloth. If by mail, postage extra. Most of the books are also published in fine editions and fine bindings at higher prices.
Descriptive Catalogues and Terms to Clubs sent free on request.

Remit by bank draft, money order, registered letter, or by express. Fractions of one dollar may be sent in postage stamps. Address

AMERICAN BOOK EXCHANGE,
JOHN B. ALDEN, Manager. Tribune Building, New York.

AGENCIES.—Boston, H. L. Hastings; Philadelphia, Leary & Co.; Cincinnati, Robert Clarke & Co.; Indianapolis, Bowen, Stewart & Co.; Cleveland, Ingham, Clarke & Co.; Toledo, Brown, Eager & Co.; Chicago, Alden & Chadwick.

HODGKINS & HAIGH, Importers, Manufacturers, and Dealers in
FIRE ARMS AND SPORTING GOODS,
300 BROADWAY, NEW YORK,
Every article of substantial merit known to the Trade supplied, and orders solicited.

Pyrometers. For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc. HENRY W. BULKLEY, Sole Manufacturer, 149 Broadway, N. Y.

OPEN BACK PRESSES. STILES & PARKER PRESS CO., Middletown, Ct.

Pictet Artificial Ice Co., Limited,
P. O. Box 3083. 142 Greenwich St., New York. Guaranteed to be the most efficient and economical of all existing Ice and Cold Air Machines.

COLUMBIA BICYCLE.
A practical road machine. Endorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of The Bicycling World.
THE POPE M'F'G CO., 89 Summer Street, Boston, Mass.

H. W. JOHNS' ASBESTOS
LIQUID PAINTS, ROOFING, BOILER COVERINGS, Steam Packing, Sheathings, Fireproof Coatings, Cements, &c. SEND FOR SAMPLES, ILLUSTRATED CATALOGUE, AND PRICE LIST.
H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

The Asbestos Packing Co.,
Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:
PATENTED ASBESTOS ROPE PACKING,
" " LOOSE "
" " JOURNAL "
" " WICK "
" " MILL BOARD,
" " SHEATHING PAPER,
" " FLOORING FELT,
" " CLOTH.

WIRE ROPE
Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York. Wheels and Rope for conveying power long distances. Send for circular.

A PLANING MILL OUTFIT FOR SALE very low for cash. Will sell all together or each machine separate. All first class machines; good order. J. H. KERRICK & CO., Indianapolis, Ind.

THE TANITE CO., STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ICE-HOUSE AND REFRIGERATOR.—Directions and Dimensions for construction, with one illustration of cold house for preserving fruits from season to season. The air is kept dry and pure throughout the year at a temperature of 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 116. Price 10 cents. To be had at this office and of all newsdealers.

TELEGRAPH and Electrical Supplies. Send for Catalogue. C. E. JONES & BRO., CINCINNATI, O.

PAINTERS attention: send for circulars, etc. of my latest Metallic Plates for graining oak, walnut, chestnut, ash, etc. in the quickest and excellent manner, no skill required. J. J. CALLOW, Cleveland, O.

ROOFING.
For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 32 John Street, New York.

PREVENT SLIPPING. The handsomest, as well as the safest Carriage Step made. Forged from best iron, and formed with a sunken panel, in which is secured a plating of richly moulded rubber. Durability warranted. Send for illustrated circular. Rubber Step M'f'g Co., Boston, Mass.

BOILER COVERINGS.
Plastic Cement and Hair Felt, with or without the Patent "AIR SPACE" Method.
ASBESTOS MATERIALS,
Made from pure Italian Asbestos, in fiber, mill board, and round packing. THE CHALMERS-SPENCE CO., 40 John Street, and Foot of E. 9th Street, New York.

BROWN'S PAT. SPLIT PULLEYS Shafts, Hangers.
At low prices. Largest assortment. A. & F. BROWN, 57, 59, & 61 Lewis St., New York.

PROSPECTUS
OF THE
Scientific American
FOR 1880.
The Most Popular Scientific Paper in the World.
VOLUME XLII. NEW SERIES.
Only $3.20 a Year, including postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular resume of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.